CHAPTER 2

Sandia National Laboratories/New Mexico Operations

Chapter 2 provides an overview of Sandia National Laboratories/New Mexico (SNL/NM) operations, programs, and facilities. It begins with a description of the history of the laboratory and site-wide operations, followed by a discussion of SNL/NM support for U.S. Department of Energy (DOE) mission lines, programs, and projects. Descriptions of selected facilities and their operations are located at the end of the chapter.

During World War II, nuclear weapons were designed, developed, and tested entirely at Los Alamos Laboratory. In late 1945, Los Alamos Laboratory began transferring its field-testing and engineering organization, known as Z-Division, to Sandia Base, near Albuquerque. This organization was the nucleus of what became Sandia Laboratory in 1949. The initial focus of the newly formed Sandia Laboratory was on nuclear weapons engineering and production coordination, with a growing emphasis on research and development (R&D) to improve weapons design.

By 1952, the Sandia Laboratory focused on weapons development. The laboratory undertook extensive field testing of components, supported the atmospheric tests by its partner laboratories, and established an advanced development group to anticipate future projects regarding nuclear weapons proliferation, weapons development, and treaty monitoring technologies.

In the 1960s and early 1970s, the growing emphasis on strengthening engineering applications resulted in new missions lines and programs. These new areas, energy research and safeguards and security, addressed international concerns such as the energy crisis and international terrorism. They remain as current programs in the areas of nuclear, fossil, and renewable energy.

As international arms control efforts increased in the late 1970s and throughout the 1980s, the U.S. emphasized treaty monitoring, safety, security, and control of the national nuclear weapons stockpile. With the end of the Cold War in the late 1980s, the role of SNL/NM (formerly known as Sandia Laboratory), to act as stockpile steward ensuring nonproliferation and continued safety, security, and reliability, took on greater importance.

The DOE uses management and operating (M&O) contractors to manage its facilities, including SNL/NM. SNL/NM was managed and operated by American Telephone and Telegraph (AT&T) from 1949 to 1993. In 1993, the M&O contract was awarded to Sandia Corporation, a subsidiary of Martin Marietta Corporation, now known as Lockheed Martin Corporation.

2.1 SNL/NM SUPPORT FOR DOE MISSION LINES

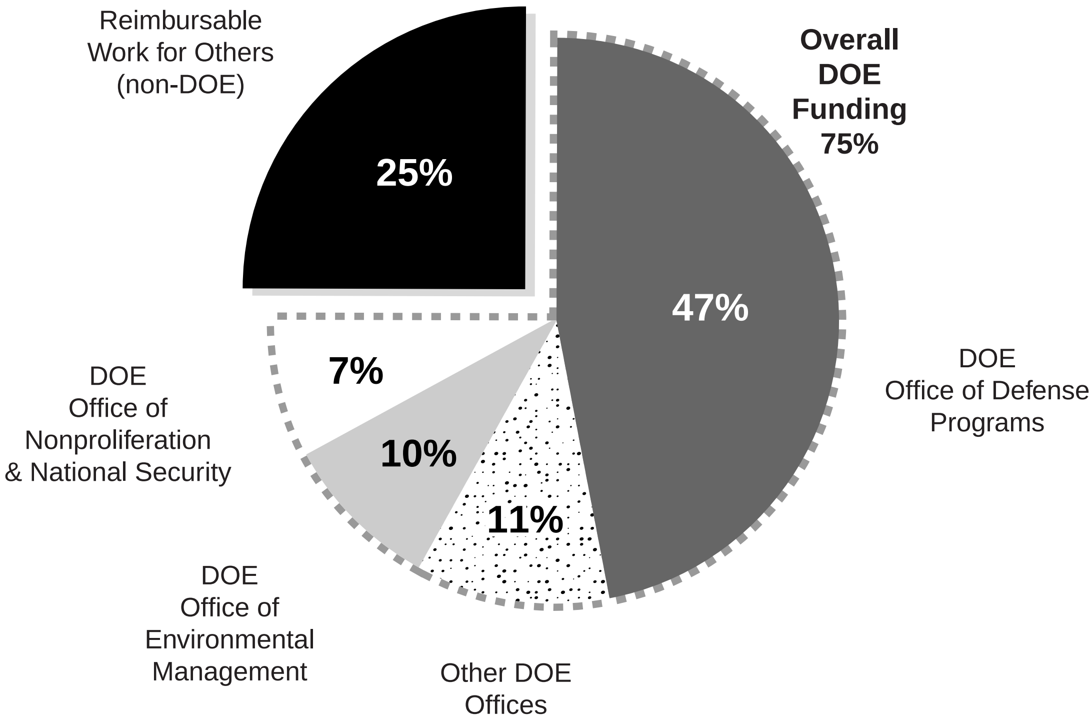
As discussed in Chapter 1, the DOE is responsible for ensuring the safety, reliability, and effectiveness of the nation's nuclear deterrent; fostering a secure and reliable energy system that is environmentally and economically sustainable; reducing the environment, safety, and health risks and impacts from DOE facilities and materials; maintaining leadership in basic research; and advancing scientific knowledge.

SNL/NM has unique capabilities that support the DOE Office of the Assistant Secretary of Defense Programs (DP) and other DOE programs. DP provides approximately 47 percent of SNL/NM's budget (Figure 2.1–1).

SNL/NM conducts R&D activities involving over 90 percent of the individual nonnuclear parts of a typical nuclear weapon.

SNL/NM's primary capabilities, as listed in Chapter 1, are as follows:

- Supporting stockpile surveillance activities of hardened weapons systems and components to ensure these systems function properly when exposed to radiation from hostile sources, whether encountered by satellites and reentry vehicles in space or by the conditions created by nuclear detonations. SNL/NM integrates experimentation and computational simulation in support of radiation effects testing, radiation transport, diagnostics, and analyses to certify that electrical, mechanical, energetic, and other nonnuclear components will operate as designed in such hostile radiation environments.



Source: SNL/NM 1997i

Figure 2.1–1. SNL Funding Sources by Major Program

SNL funding is provided by a variety of major programs.

- Developing specific, limited "piece parts" required to repair deterioration or defects in existing weapons components or to make modifications essential to maintaining deterrent credibility as the existing stockpile continues to shrink and age.
- Characterizing and demonstrating the utility of pulsed-power-generated soft X-ray sources for weapons physics and inertial confinement fusion experiments. SNL/NM combines diagnostics, modeling, and simulation codes in designing and qualifying pulsed-power components and target R&D.
- Developing fundamental capabilities required to take advantage of computational engines ranging from clusters of components to massively parallel units to large state-of-the-art platforms. Expertise ranges from fundamental, broadly applicable efforts to those of a developmental nature, all of which support both high-end computing and specific stockpile systems simulations.
- Conducting computer science research that addresses computational methods and technologies such as numerical methods for designing and processing new stockpile materials, new massively parallel numerical algorithms, and new strategies for code reusability, portability, and debugging. SNL/NM develops codes for simulating shock, high-velocity impact, penetration, or blast, and develops computational techniques that can represent fundamental circumstances and processes with the capability to provide predictive solutions.
- Developing radiation transport models that address three-dimensional radiation deposition for heat-based structure response and heat-based mechanical shock of systems in hostile environments.
- Manufacturing neutron generators, switches, and tubes. SNL/NM provides technical analysis, engineering design, and manufacturing support for nonnuclear components, as well as nonnuclear component dismantlement support.
- Providing sensor development, technical analysis, and export license support for the control and prevention of nuclear and nonnuclear (chemical, biological, explosive, and missiles) proliferation. Detection technology capabilities include airborne, satellite, seismic, and chemical-based monitoring systems.

- Producing a number of medical radioisotopes including iodine-131 and molybdenum-99, the primary isotope used in nuclear medicine in the U.S. SNL/NM supports the development of optimized production and processing, cooperation with private industry, and technology transfer.
- Conducting fundamental energy research in a wide variety of energy resources including electrical energy, energy storage, hydrogen storage (fuel cells), fossil fuels, geothermal technology (wireless telemetry), solar energy technology, photovoltaics (silicon cell), applied wind power technology, and light-water reactor technology.
- Conducting numerous projects that contribute to DOE's science and technology mission. These include activities in scientific computing, basic energy sciences, and magnetic fusion energy; developing methods using computational science research for solving scientific and engineering problems and a software infrastructure for parallel computing; using the performance and cost advantages of massive parallelism to meet critical DOE mission requirements in advanced computing; conducting scientific research, development, and applied engineering on materials and systems in areas of chemistry, physics, material science, biology, and environmental sciences; and designing components for fusion plasma environments.
- Managing, storing, and treating a variety of wastes. SNL/NM also develops technology to improve waste processing and reduce impacts to the environment, including long-term waste disposal facilities such as Waste Isolation Pilot Plant (WIPP).
- Restoring, monitoring, and treating a variety of environmental cleanup sites. SNL/NM develops technology (including remote robotics) to improve environmental restoration processes to reduce impacts to the environment.

The DOE directs SNL/NM activities in support of its programs and missions. In turn, SNL/NM's facilities and operations are designed to meet the requirements of the programs, projects, and activities assigned to the laboratory. Figure 2.1–2 illustrates the DOE's funding, by mission, to SNL/NM facilities. Table 2.1–1 lists DOE mission lines by DOE mission and office. Following are brief descriptions of DOE mission assignments to SNL/NM.

2.1.1 SNL/NM Support for DOE's National Security Mission Line

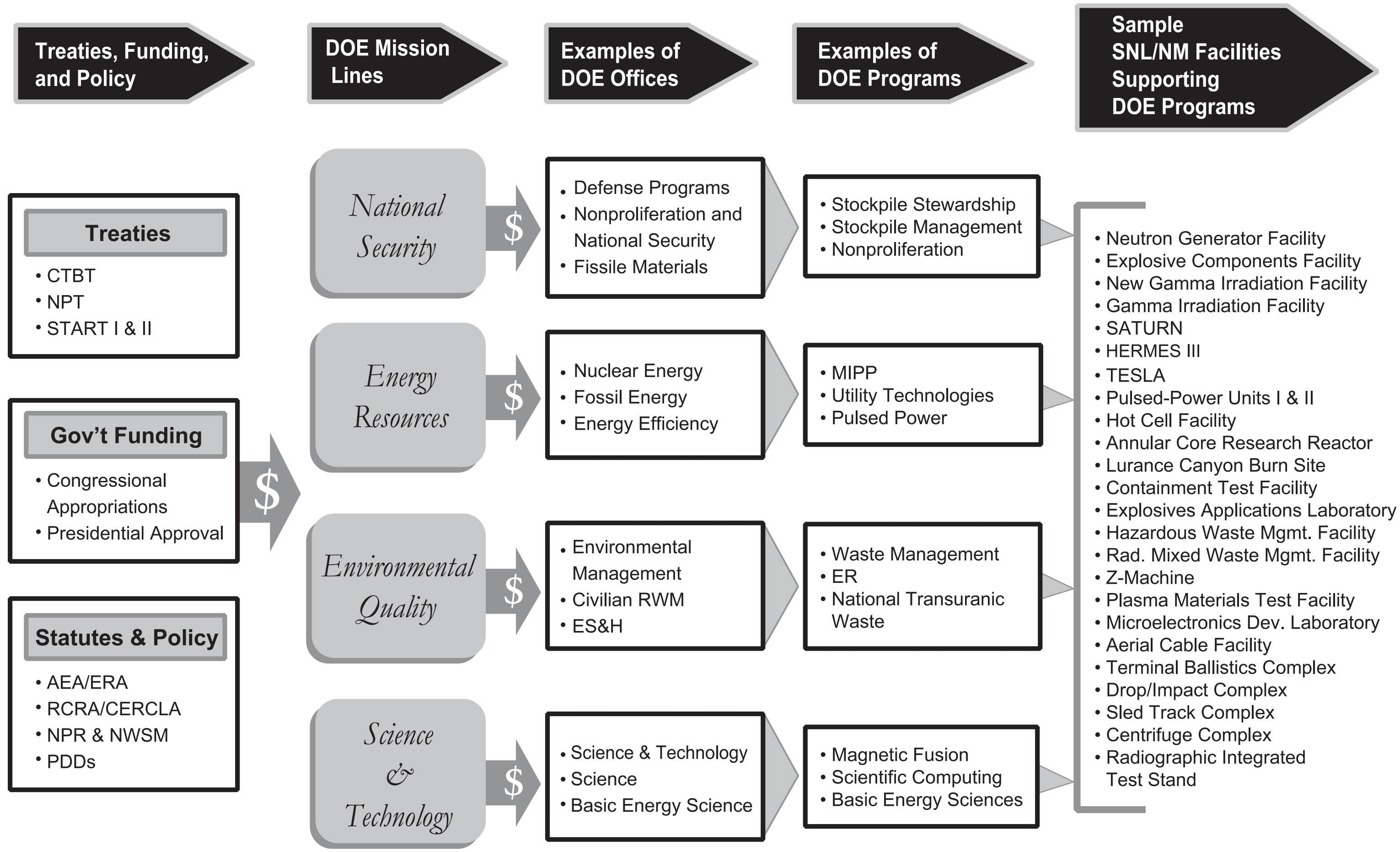
SNL/NM's principal DOE assignments under this mission line focus on the nuclear stockpile and reducing the vulnerability of a reduced stockpile; managing nonnuclear components of every weapon in the U.S. nuclear weapons stockpile; and reducing the vulnerability of the U.S. to threats of proliferation and to the use of weapons of mass destruction, nuclear incidents, and environmental damage. Following are the major DOE programs under this mission line:

- *Stockpile Stewardship*—Tasks involve stockpile upgrades, material and component tests involving hostile environmental exposures, computer-simulated testing, performance assessments, systems component engineering, chemistry and material science activities, stockpile computations, and new technology development.
- *Stockpile Management*—SNL/NM provides capabilities in onsite and offsite manufacturing; design of nonnuclear components, systems, and materials; production support; quality assurance; stockpile surveillance; component dismantlement; and accident response support. SNL/NM supplies, certifies, and tests shipping containers including nuclear component and tritium containers.
- *Nonproliferation*—Material control includes support in the following areas: verification R&D; nuclear safeguards and security; arms control; material protection, control, and accounting; proliferation prevention; and intelligence.

In 1997, SNL/NM undertook 218 R&D projects using DOE-focused technologies and unique SNL/NM science and engineering capabilities (SNL 1998a). Nearly 46 percent of the projects had applications that were national security-related.

2.1.2 SNL/NM Support for DOE's Energy Resources Mission Line

SNL/NM supports DOE assignments under this mission line to enhance the safety, security, and reliability of energy, focusing on implications for our nation's security related to the increasing interdependencies among domestic elements and global resources. SNL/NM helps develop strategies to protect the supply of the nation's energy resources. SNL/NM applies science and technology capabilities to develop various technologies. Following are the major DOE programs under this mission line:



AEA - *Atomic Energy Act*
CTBT - Comprehensive Test Ban Treaty
CERCLA - *Comprehensive Environmental Response, Compensation & Liability Act*
ES&H - Environment, Safety, and Health
ERA - *Energy Reorganization Act*
ER - Environmental Restoration
HERMES - High Energy Radiation Megavolt Electron Source
MIPP - Medical Isotopes Production Project
NPR - Nuclear Posture Review
NPT - Nuclear Nonproliferation Treaty
NWSM - Nuclear Weapons Stockpile Memorandum
PDDs - Presidential Decision Directives
RCRA - *Resource Conservation and Recovery Act*
RWM - Radioactive Waste Management
START - Strategic Arms Reduction Treaty
TESLA - Tera-Electron Volt Energy Semiconducting Linear Accelerator

Source: Original

Figure 2.1–2. Flow of DOE Funding by Mission Line to SNL/NM
The DOE's funding flows through various DOE offices to SNL/NM.

Table 2.1–1. DOE Mission Lines and DOE Office Mission Statements

DOE MISSION LINE	DOE OFFICE	MISSION STATEMENT
National Security	Defense Programs	To ensure the safety, reliability, and performance of nuclear weapons without underground testing
	Nonproliferation & National Security	To support DOE activities related to nonproliferation, nuclear safeguards and security, classification and declassification, and emergency management
	Fissile Materials Disposition	To reduce the global nuclear danger associated with inventories of surplus weapons usable fissile materials
Energy Resources	Nuclear Energy	To support the successful decontamination and decommissioning of nuclear reactor sites; certify next-generation nuclear power plants; ensure the availability of industrial and medical isotopes and radioisotope power systems for space exploration
	Fossil Energy	To enhance U.S. economic and energy security
	Energy Efficiency	To lead the nation to a stronger economy, a cleaner environment, and more secure future through development and deployment of sustainable energy technologies
Environmental Quality	Environmental Management	To develop a clear national cleanup strategy with a strong commitment to results that will gain the trust and confidence of Congress, the states, Native American tribes, and the public
	Civilian Radioactive Waste Management	To develop, construct, and operate a system for spent nuclear fuel and high-level radioactive waste disposal, including a permanent geologic repository, interim storage capability, and transportation system
	Environment, Safety, & Health	To protect the environment and the health and safety of workers at DOE facilities and the public
Science & Technology	Science & Technology	To manage and direct targeted basic research and focused, solution-oriented technology development
	Science	To improve and advance the science and technology foundations and effective use and management of DOE laboratories
	Basic Energy Science	To advance the scientific and technical knowledge and skills needed to develop and use new and existing energy resources in an economically viable and environmentally sound manner

Source: DOE 1997c

- *Medical Isotopes Production*—Tasks include developing a U.S. source for the molybdenum-99 isotope and other isotopes that have widespread medical applications. The project uses the Annular Core Research Reactor (ACRR) and the Hot Cell Facility (HCF). Detailed information is provided in the *Medical Isotopes Production Project: Molybdenum-99 and Related Isotopes Environmental Impact Statement* (DOE 1996b).
- *Utility Technologies*—Utility technologies support includes developing clean, renewable, and more economical sources of electricity. SNL/NM supports aggressive R&D in photovoltaic, solar thermal, wind, geothermal, hydropower, and biomass power technologies and systems.
- *Pulsed-Power*—Pulsed-power tasks include developing fusion capabilities and experimenting with X-ray sources for understanding harsh electromagnetic, shock, and debris environments. SNL/NM supports R&D in radiography and accelerator technology.

Of the previously mentioned R&D projects in 1997, about 16 percent had applications that were energy resource-related.

2.1.3 SNL/NM Support for DOE's Environmental Quality Mission Line

SNL/NM supports DOE assignments under this mission line with onsite operations and developing technology for national environmental problems. Activities include some treatment, temporary storage, and offsite disposal of hazardous waste, low-level waste (LLW), low-level mixed waste (LLMW), transuranic waste (TRU), mixed transuranic waste (MTRU), and solid wastes generated by ongoing mission-related activities. Environmental restoration activities are ongoing at SNL/NM, with most remedial actions scheduled for completion by the end of 2004. Following are the major DOE programs under this mission line:

- *Waste Management*—Tasks include some treatment, storage, and offsite disposal of wastes in a manner that is safe to humans and the environment. The Hazardous Waste Management Facility (HWMF) and Radioactive and Mixed Waste Management Facility (RMWMF) manage a variety of wastes in accordance with applicable laws, permits, and regulations.
- *Environmental Restoration*—Environmental restoration activities include the assessing and cleaning up of inactive sites contaminated from previous defense and nondefense-related programs. SNL/NM activities are conducted in accordance with applicable Federal, state, and local laws and regulations.
- *National TRU Waste Program*—activities include site assessments, performance assessments, regulatory compliance support, and science research in support of the WIPP.

Of the previously mentioned R&D projects in 1997, about 24 percent had applications that were environmental quality-related.

2.1.4 SNL/NM Support for DOE's Science and Technology Mission Line

SNL/NM's facilities and expertise are used in support of this mission line through R&D in modeling and simulation testing, physical sciences, and advanced chemical and materials sciences. SNL/NM activities include developing radiation-hardened microelectronic components; computer-based testing, modeling, and simulation; and pulsed-power technology. Following are the major DOE programs under this mission line:

- *Magnetic Fusion*—R&D activities involving studying materials, components, and development processes.
- *Scientific Computing*—Advanced mathematical modeling, computational R&D, communication sciences, and information technologies.
- *Basic Energy Sciences*—R&D in material sciences, chemical sciences, energy biosciences, and engineering.

Of the previously mentioned R&D projects in 1997, about 15 percent had applications that were science and technology-related.

2.2 REIMBURSABLE WORK FOR OTHERS

SNL/NM performs reimbursable work for other Federal agencies and sponsors, including the private sector. This work, also known as work for others (WFO), must be compatible with the DOE mission work conducted at SNL/NM and must be work that cannot reasonably be performed by the public sector. Approximately 25 percent of SNL's funding is reimbursable work for agencies and organizations other than the DOE (Figure 2.1–1). SNL/NM activities support other Federal departments and agencies. The major agencies include the U.S. Department of Defense, U.S. Nuclear Regulatory Commission, U.S. Department of Transportation (DOT), National Aeronautics and Space Administration, Department of State, and U.S. Environmental Protection Agency (EPA). Details regarding WFO support activities and projects are provided in SNL/NM's *Facilities and Safety Information Document* (FSID) (SNL/NM 1997b), and the *SNL Institutional Plan FY 1998-2003* (SNL 1997b).

Universities and others can use SNL/NM facilities to conduct research. SNL/NM collaborates with the University of New Mexico in the materials science area.

2.3 SNL/NM FACILITIES: A FRAMEWORK FOR IMPACTS ANALYSIS

As discussed above, SNL/NM provides a diverse set of capabilities that support DOE's mission lines through various programs. The major consideration in deciding to analyze impacts by facility rather than by program was the complexity of the analysis. Any given program may use operations in more than one facility, and many facilities serve multiple programs. An analysis of environmental impacts requires knowledge of particular activities in a particular place over a known span of time in order to project the effect those activities will have on the surrounding environment. A presentation of impacts by program would require that impacts from operations at each facility be subdivided into the contribution from each program using the facility. The resulting impacts would then have to be reassembled by program. The complexity of analysis would greatly increase, and the clarity of the presentation would suffer. Therefore, the DOE chose to group the operations to be analyzed by facility.

To accomplish this objective, the DOE used the results of a detailed questionnaire distributed throughout SNL/NM to develop a database containing pertinent information about the approximately 670 buildings in the 5 technical areas (TAs) and structures in the Coyote Test Field. An initial screen of these facilities, along with the details of how the screen was performed, is described and the facilities are listed in the FSID (SNL/NM 1997b).

This list was then further assessed and refined by qualitatively evaluating the types of operations performed, identifying those with the highest potential for environmental impacts or concerns, and then grouping them according to function and location. Key qualitative criteria used in the final screen identified facilities or facility groups with operations that have generated important public concern in the past or have a relatively greater impact to the environment, safety, and health. The criteria used in this final screening process are described in Section 2.3.1 and illustrated in Figure 2.3–1.

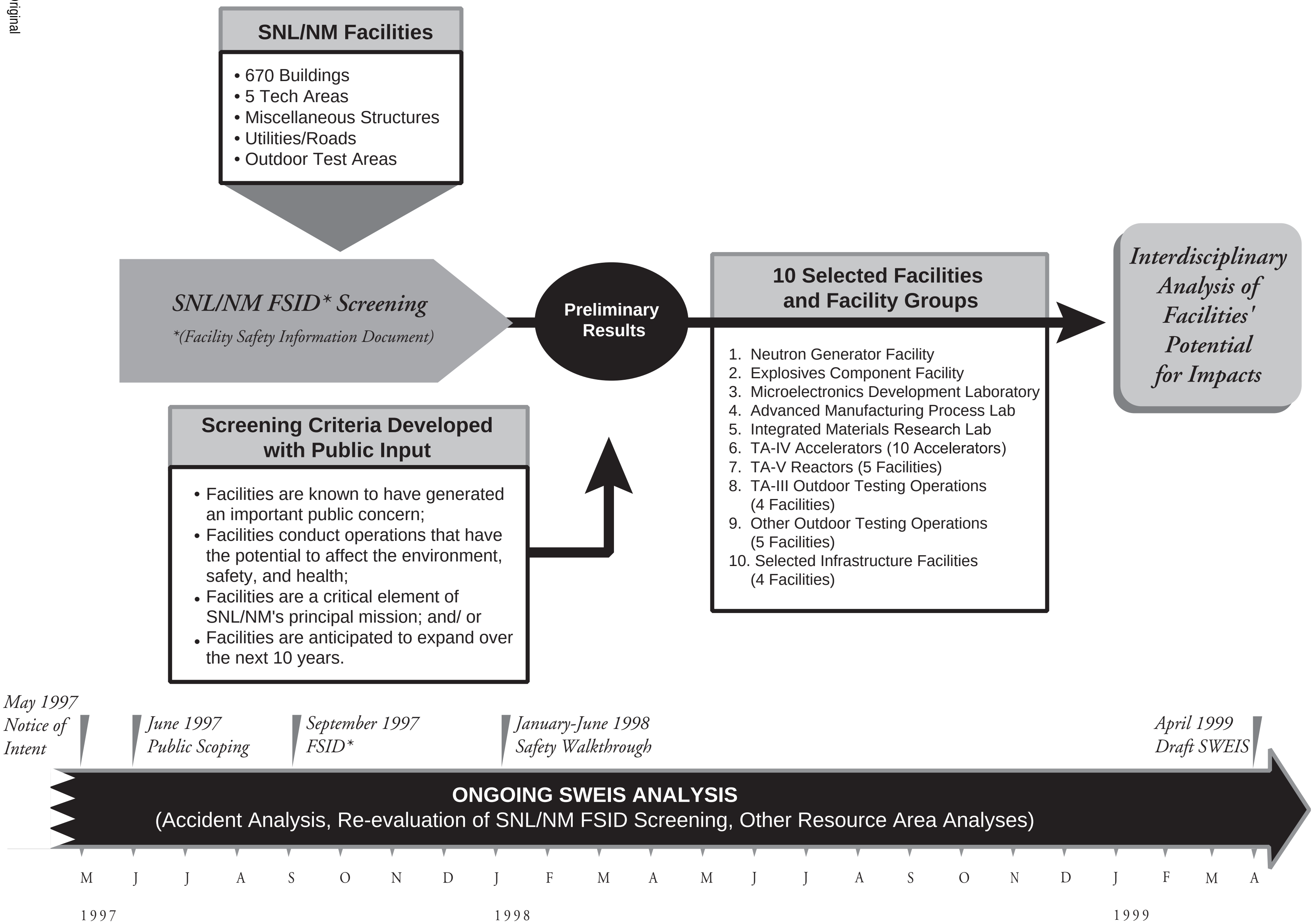
The operations within these facilities or facility groups are the basis for differentiating between the three alternatives analyzed in the SWEIS and any associated environmental impacts. Taken together, these facilities and facility groups represent the majority of exposure risks associated with continuing operations at SNL/NM. They represent

- over 99 percent of all radiation doses to SNL/NM personnel.
- over 99 percent of all radiation doses to the public.
- from 81 to 99 percent of stationary source criteria pollutants (nitrogen dioxide, carbon monoxide, PM_{10}, sulfur dioxide), depending on the alternative. This does not include hazardous air pollutants or toxic air pollutants, which instead are analyzed on a facility-wide basis in the SWEIS. The remaining stationary source criteria pollutants would be associated with backup generators.
- all radioactive waste volumes, including medical isotopes production, Environmental Restoration (ER) Project wastes, and hazardous wastes, which are accounted for in analyses of infrastructure, radiological air quality, transportation, and waste generation.

2.3.1 Facility Screening Process

To be selected for detailed analysis, a facility or facility group had to meet one or more of the following criteria:

- be known to have generated an important public concern;
- conduct operations that have the potential to affect the environment, safety, and health;
- be a critical element of one of SNL/NM's principal missions; and/or
- be anticipated to expand over the next 10 years, likely resulting in the need for additional *National Environmental Policy Act* (NEPA) documentation.



Source: Original

Figure 2.3–1. SWEIS Analysis of SNL/NM Facilities

An SNL/NM facility screening process was used during SWEIS analysis of potential impacts.

2.3.2 Framework for Analysis

The SWEIS evaluates SNL/NM facilities and operations and their effects on environmental conditions under the three alternatives. Because of their importance, potential environmental impacts from the selected facilities are described and evaluated in greater detail than other SNL/NM facilities. This in-depth look at selected facilities provides the framework for analyzing impacts.

For completeness of analysis, the DOE also gathered information on the balance of operations at SNL/NM. Information regarding other facilities, site support services, water and utility use, waste generation, hazardous chemicals purchased for use, process wastewater, and radioactive dose data were incorporated into the analysis. The DOE examined all nuclear/radiological facilities and hazardous nonradiological facilities and associated DOE-approved safety documents (for example, safety analysis reports, safety assessments, and hazard assessments) for SNL/NM facilities. In addition, facility walk-throughs and interviews were performed to ensure that all hazards and safety concerns were properly captured in the accident analysis. This information is included in the current environmental consequences (Chapter 5) and Appendix F. In addition, some aspects of the impact analysis considered individual facility operations, regardless of whether the entirety of the facility met the criteria for detailed analysis. These aspects included evaluating chemical air emissions and radiological air emissions. This type of specific information, as well the contribution to impacts in all resource areas from the balance of operations at SNL/NM, including ongoing R&D activities, is included in the analysis of each alternative.

The following sections provide an overview of the TAs at SNL/NM and describe the facilities the DOE identified for detailed analysis.

2.3.3 Technical Areas

DOE mission lines are executed at SNL/NM through program funding at multiple facilities. Facility operations are conducted within five TAs and many additional outdoor test areas, including an area of test facilities known as the Coyote Test Field. These TAs comprise the basic geographic configuration of SNL/NM. Figure 2.3–2 illustrates the five TAs. TA-I is the main administration and site support area and also contains several laboratories. TA-II consists primarily of support service facilities along with the new Explosive Components Facility (ECF), several active and inactive waste management facilities, and vacated facilities replaced by the ECF. TA-III is devoted primarily to physical testing, TA-IV is primarily accelerator operations, and TA-V is primarily reactor facilities. The Coyote Test Field and the Withdrawn Area are used primarily for outdoor testing. A complete listing of all the facilities in each TA is presented in the FSID (SNL/NM 1997b).

2.3.4 Selected SWEIS Facilities

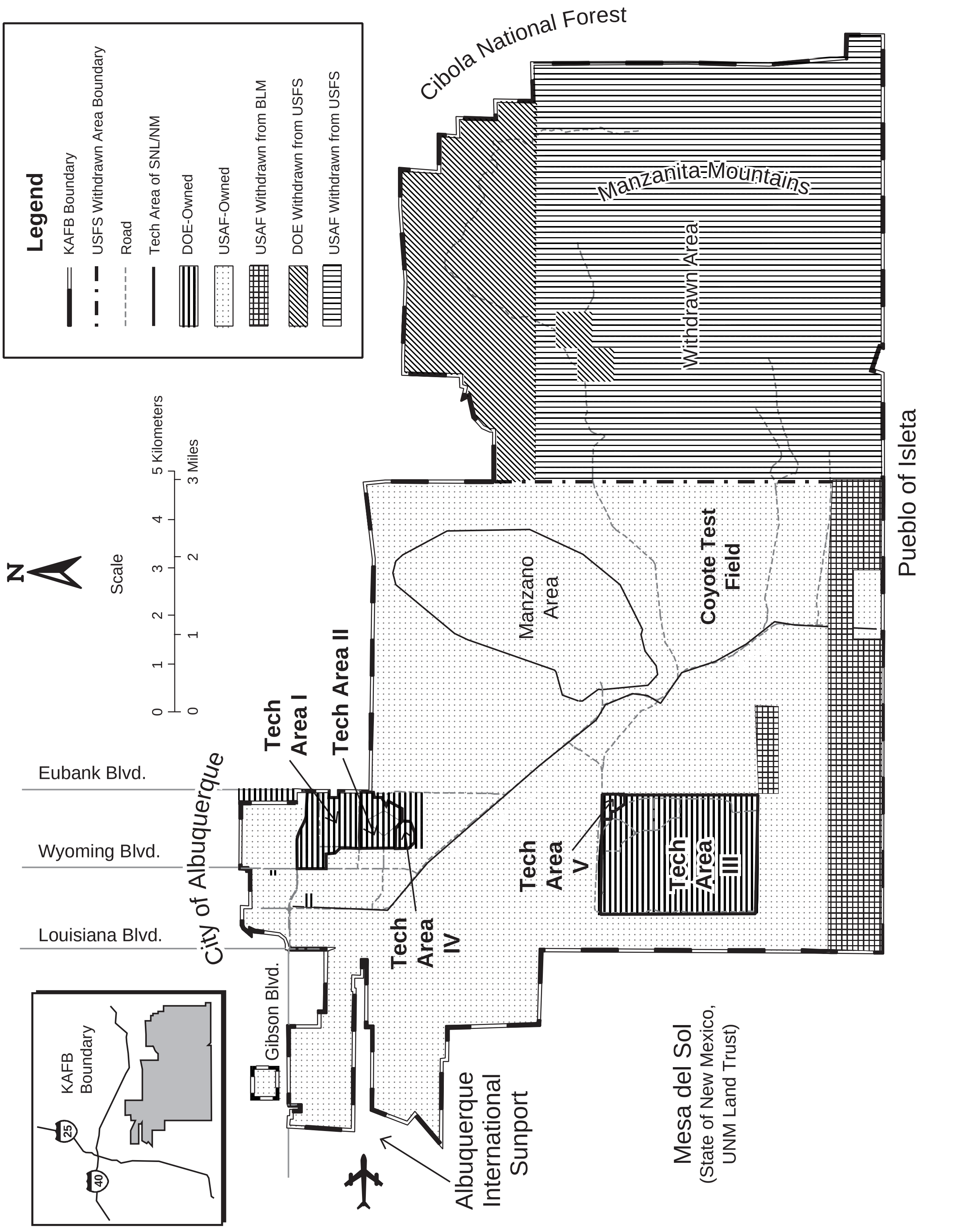
Table 2.3–1 identifies the 10 facilities or facility groups selected for in-depth analysis. Taken together, these facilities represent the main activities at SNL/NM that have the potential to affect the environment, have generated public concern, are critical to SNL/NM's missions, or are anticipated to expand over the next 10 years. TA-I and TA-II contain five selected facilities that fall into the categories of manufacturing, R&D laboratories, and testing described in Section 2.3.4.1, below. The five other selected facility groups include the following:

- physical testing and simulation facilities (TA-III) (Section 2.3.4.2),
- accelerator facilities (TA-IV) (Section 2.3.4.3),
- reactor facilities (TA-V) (Section 2.3.4.4),

Table 2.3–1. Facilities/Facility Groups Selected for Analyzing SNL/NM Operations

SELECTED FACILITIES/FACILITY GROUPS	LOCATION
1. *Neutron Generator Facility*	TA-I
2. *Microelectronics Development Laboratory*	TA-I
3. *Advanced Manufacturing Processes Laboratory*	TA-I
4. *Integrated Materials Research Laboratory*	TA-I
5. *Explosive Components Facility*	TA-II
6. *Physical Testing and Simulation Facilities*	TA-III
7. *Accelerator Facilities*	TA-IV
8. *Reactor Facilities*	TA-V
9. *Outdoor Test Facilities*	Coyote Test Field and Withdrawn Area
10. *Selected Infrastructure*	TA-I and TA-III

Source: SNL/NM 1997b
TA: technical area



Source: SNL/NM 1997j

Figure 2.3–2. Locations of Technical Areas and Outdoor Test Facilities on Kirtland Air Force Base

SNL/NM conducts operations within five technical areas and several outdoor test areas, including the Coyote Test Field.

- outdoor test facilities (including Coyote Test Field and the Withdrawn Area) (Section 2.3.4.5), and
- selected infrastructure facilities (Section 2.3.4.6).

2.3.4.1 Manufacturing, R&D Laboratories, and Testing Facilities

The five selected facilities located in TA-I and TA-II are described below (SNL/NM 1997b).

- *Neutron Generator Facility (NGF)*—Manufactures neutron generators, which provide a controlled source of neutrons.
- *Microelectronics Development Laboratory (MDL)*—Performs R&D and fabricates custom and radiation-hardened microelectronics.
- *Advanced Manufacturing Processes Laboratory (AMPL)*—Performs R&D of technologies, practices, and unique equipment and fabricates prototype hardware for advanced manufacturing processes.
- *Integrated Materials Research Laboratory (IMRL)*—Performs R&D of semiconducting and other specialized materials, including silicon processing and equipment development and materials synthesis, growth, processing, and diagnostics.
- *Explosive Components Facility (ECF)*—Performs R&D and testing of explosives components, neutron generators, batteries, and explosives.

2.3.4.2 Physical Testing and Simulation Facilities

TA-III is composed of numerous principal buildings and structures devoted to the physical testing and simulation of a variety of natural and induced environments. The facilities include extensive environmental test facilities, such as sled tracks, centrifuges, and a radiant heat facility. Other facilities include an inactive paper incinerator; a large melt facility; and the formerly used Chemical Waste, LLW, and LLMW landfills. Major outdoor operations located in TA-III include the following (SNL/NM 1997b):

- *Terminal Ballistics Complex*—Provides a test environment for ballistics studies and terminal effects.
- *Drop/Impact Complex*—Provides a controlled environment for high velocity impact testing on hard surfaces, water impact testing, and underwater testing.
- *Sled Track Complex*—Simulates high speed impacts of weapons shapes, substructures, and components to verify design integrity, performance, and fuzing functions; tests parachute systems to aerodynamic loads.
- *Centrifuge Complex*—Simulates the forces of acceleration produced by missiles and aircraft for test packages that include satellite systems, re-entry vehicles, rocket propellants, sensing devices of weapons, and weapons system components.

2.3.4.3 Accelerator Facilities

TA-IV contains several inertial-confinement fusion research and pulsed-power research facilities. Facilities include a large "Z-pinch" accelerator known as the Z-Machine, and the Simulation Technology Laboratory (STL), which houses seven pulsed-power accelerators that are used to simulate the effects of nuclear detonations and various atmospheric conditions on nonnuclear components and subsystems. The accelerators are also used to conduct research on inertial-confinement fusion and particle-beam weapons. Another accelerator facility, SATURN, and a research facility are also located in TA-IV. Accelerator operations located in TA-IV are described below (SNL/NM 1997b).

- *SATURN Accelerator*—Simulates the radiation effects of nuclear countermeasures on electronic and material components.
- *High-Energy Radiation Megavolt Electron Source III (HERMES III) Accelerator*—Provides gamma-ray effects testing for component and weapon systems development, which helps ensure operational reliability of weapon systems in radiation environments caused by nuclear explosions.
- *Sandia Accelerator & Beam Research Experiment (SABRE)*—Supports the inertial confinement fusion program for advanced extraction ion diode research and for target and focusing studies.
- *Short-Pulse High Intensity Nanosecond X-Radiator (SPHINX) Accelerator*—Measures X-ray-induced photocurrents from short pulses in integrated circuits and thermostructural response in materials.
- *Repetitive High Energy Pulsed-Power Unit I (RHEPP I) Accelerator*—Supports the development of technology for continuous operation of pulsed-power systems.
- *Repetitive High Energy Pulsed-Power Unit II (RHEPP II) Accelerator*—Supports the development of technology for continuous operation of pulsed-power systems for very high power outputs.
- *Z-Machine Accelerator (formerly the Particle Beam Fusion Accelerator)*—Generates high intensity light-ion beams for the inertial confinement fusion program and the high energy/density weapons physics program for stockpile stewardship.

Accelerators

Accelerators are devices that accelerate (speed up) the movement of atomic-sized particles such as electrons, protons, and ions. Examples of these devices range from huge cyclotrons to television sets. The accelerators in TA-IV use pulsed-power technology and are called pulsed-power accelerators. Accelerators can produce radiation by accelerating protons that strike target atoms, thereby producing radioisotopes.

Pulsed-power accelerators are single-shot devices that accelerate large numbers of particles (energy) in a very short period. These accelerators are considered high power. The HERMES III accelerator, for example, can generate a 350-kJ pulse of electrons in 20 nsec, or 17 TW ($17x10^{12}$ W) of power. However, because of the low shot rate of these machines (sometimes only one per day), the average power generated is typically very low. One of the areas of research being conducted in TA-IV is to increase the shot rate, or repetition rate, of these accelerators for applications that require high average power.

The TA-IV pulsed-power accelerators are designed to compress (in time) the electrical pulse. This generates high power by transferring a high percentage of the energy while shortening the pulse.

The desire to create controlled fusion for commercial power generation initially motivated the development of pulsed-power technology. Later, it was determined that the same technology could be used to generate X-rays and gamma rays for weapons testing. New uses for pulsed-power technology are continually being explored. Usually, a particular application will require some modification to existing devices, which adds knowledge to the pulsed-power technology base. Many applications, such as materials hardening and sterilization, have resulted in the development of high-power, high-repetition-rate accelerators.

- *Tera-Electron Volt Energy Superconductior Linear Accelerator (TESLA)*—Tests plasma opening switches for pulsed-power drivers.
- *Advanced Pulsed-Power Research Module Accelerator (APPRM)*—Tests the performance and reliability of components for use in a much larger accelerator still in the conceptual stage.
- *Radiographic Integrated Test Stand (RITS) Accelerator*—Simulates nuclear weapons effects on nonnuclear components and subsystems.

2.3.4.4 Reactor Facilities

TA-V is a highly secure, remote research area housing experimental and engineering nuclear reactors. Certain facilities in this area are being converted to production facilities for medical radioactive isotopes. Reactor operations located in TA-V are discussed below (SNL/NM 1997b).

- *New Gamma Irradiation Facility (NGIF)*—Produces a gamma radiation field, simulating weapons effects on nuclear weapons components.
- *Gamma Irradiation Facility (GIF)*—Provides high intensity gamma radiation for radiation environment testing of materials, components, and systems.
- *Sandia Pulsed Reactor (SPR)*—Simulates nuclear weapons effects on nuclear weapons components. The SPR houses two fast-burst reactors, SPR II and SPR III.
- *ACRR*—Formerly used for pulsed-power research; under conversion for the production of molybdenum-99 for use in nuclear medicine.
- *HCF*—Formerly used to support pulsed-power research; under conversion for processing irradiated targets from the ACRR and the production of molybdenum-99.

2.3.4.5 Outdoor Test Facilities

Selected outdoor test facilities are located in the Coyote Test Field and the Lurance Canyon Burn Site. The Coyote Test Field is a remote area containing physics testing facilities. Lurance Canyon was used for explosives testing. Although no explosives tests are currently being conducted at Lurance Canyon, burn tests are currently conducted there. Outdoor operations in the Coyote Test Field and several canyons are discussed below (SNL/NM 1997b).

- *Containment Technology Test Facility - West*—Provides nuclear power reactor containment model testing.
- *Explosives Applications Laboratory (EAL)*—Supports the design, assembly, and testing of explosive experiments in support of site-wide programs.

Reactors

Typically, reactors are devices that provide neutron and sustained gamma-pulsed environments. The reactors in TA-V conduct a variety of experiments, including those for DP system component electronics testing and reactor safety research. The primary purpose for the ACRR is the production of medical isotopes.

Normally, the SNL/NM reactors operate at steady-state power. These reactors are considered low power. The SPR III reactor, for example, is limited to 10 kW.

TA-V reactors are designed as research reactors, small low-power reactors providing specialized near-fission ranges of radiation environments. SPR reactors, SPR II and SPR III, are small air-cooled reactors less than 8 ft tall. The ACRR would operate approximately 1,000 hours per year at a maximum power level of 4 MW (approximately 4,000 MWh per year). Commercial reactors operate at 1,000 MW of power (approximately 5,000,000 MWh per year).

The desire to produce medical isotopes can include expanding the range of isotopes to cover the broad field of medical isotopes and various research isotopes. The long-term, steady-state operation of the reactor for isotope production would allow experiments in areas of neutron irradiation, radiography, and other activities related to isotope production.

- *Aerial Cable Facility*—Provides a controlled environment for high velocity impact testing on hard surfaces and precision testing of full-scale, ground-to-air missile operations; air-to-ground ordnance testing; and nuclear material shipping container testing for certification.
- *Lurance Canyon Burn Site*—Provides safety testing of various hazardous material shipping containers, weapons components, and weapons mockups in aviation fuel fires, propellant fires, and wood fires.
- *Thunder Range Complex*—Provides inspection facility capabilities and assembly and disassembly of special explosive-containing items. In the past, the facility was used for environmental, safety, and survivability testing for nuclear weapons applications.

2.3.4.6 Selected Infrastructure Facilities

All SNL/NM structures were evaluated to identify representative infrastructure facilities. Most SNL/NM infrastructure facilities are used for office space, storage, or support. Other infrastructure support related to roads and utilities is described in Section 4.4. Following are the major infrastructure facilities at SNL/NM that have environmental permits and that have been selected for evaluation:

- *Steam Plant in TA-I*—Provides heat and hot and chilled water to buildings in TA-I and the eastern portion of Kirtland Air Force Base (KAFB).
- *HWMF in TA-I*—Provides temporary storage for hazardous SNL/NM wastes prior to offsite treatment and/or disposal.
- *RMWMF in TA-III*—Processes LLW and LLMW generated at SNL/NM to meet waste acceptance criteria at designated DOE disposal sites.
- *Thermal Treatment Facility (TTF) in TA-III*—Thermally treats (burns) small quantities of waste explosive substances, waste liquids, and items contaminated with explosive substances.

2.3.5 Activities Common to All Alternatives

Some activities at SNL/NM are not expected to change significantly, regardless of which alternative the DOE selects for continued operations. In general, these balance of operations activities involve little or no toxic materials, are of low hazard, and are usually categories of actions excluded from analysis by DOE’s NEPA regulations. Balance of operations activities were included for the appropriate resource areas. These are evaluated along with the more detailed analyses of the selected facilities for each alternative in order to provide the total impacts from SNL/NM operations. They include many R&D activities and routine operations; infrastructure, administrative, and central services for SNL/NM; traffic flow adjustments to existing onsite roads in predisturbed areas, including road realignment and widening; facility maintenance and refurbishment activities; and environmental, ecological, and natural resource management activities. Some routine refurbishment, renovation, and small-scale removal of specific surplus facilities and closures will also continue at SNL/NM. Examples include office buildings, trailers, storage facilities, and infrastructure. A detailed description of these routine activities is available in the FSID (SNL/NM 1997b).

2.3.5.1 Research & Development Activities

R&D activities at SNL/NM are focused in the following areas: materials and process science, computational and information sciences, microelectronics and photonics sciences, engineering sciences, and pulsed-power sciences. Many aspects of the programs described in Section 2.1 fall into these areas of R&D, which are not analyzed in detail.

SNL/NM's research foundation in materials and process science develops the scientific basis for current and future mission needs. New and replacement materials are created for refurbished weapons components, enhanced safety subsystems, and advanced energy storage devices.

SNL/NM's research foundation in computational and information sciences develops technology to transition from model- and simulation-based life-cycle engineering. Increases in supercomputing capabilities are needed to analyze complicated accident scenarios, to design weapons components and systems, and to predict the aging of key stockpile materials.

SNL/NM's research foundation in microelectronics and photonics provides the science and technology to ensure implementation of its electronics systems. This research foundation conducts activities ranging from fundamental solid-state physics to design and fabrication of radiation-hardened integrated circuits.

SNL/NM's research foundation in engineering sciences focuses on model- and simulation-based, life-cycle engineering. Life-cycle engineering at SNL/NM occurs within a comprehensive validated modeling and simulation environment required for validation and verification of simulations.

SNL/NM's research foundation in fast pulsed-power technology applies technological advances in conjunction with other DOE laboratories, U.S. industry, and universities. SNL/NM supports science-based stockpile stewardship by providing radiation experiments to certify the survivability of strategic systems in the stockpile and to support DOE initiatives such as the Stockpile Life Extension Program. The large-volume, high-temperature, high-energy-density environments uniquely generated with pulsed power have produced a unique opportunity to collaborate with Lawrence Livermore National Laboratory and Los Alamos National Laboratory (LANL) in weapons physics and experimentation. These capabilities are especially critical in the absence of underground nuclear testing for certification of weapons survivability and performance (SNL/NM 1997b).

2.3.5.2 Maintenance Support Activities

These activities comprise frequently and routinely requested maintenance services for operational support of SNL/NM facilities and associated DOE properties. Activities range from ongoing custodial services to corrective, preventive, predictive, and training actions required to maintain and preserve buildings, structures, roadways (including widening in disturbed areas), and equipment in a condition suitable for fulfilling their designated purposes. While these activities are intended to maintain current operations, they would not substantially extend the life of a facility or allow for substantial upgrades or improvements.

2.3.5.3 Material Management and Operations

Routine operations at SNL/NM require the management of hazardous, industrial, commercial, and recyclable materials. Appendix A contains information regarding the responsible organizations, regulatory requirements, and types and quantities of material at SNL/NM. SNL/NM standards, which were developed in accordance with DOE, DOT, and U.S. Air Force policies, determine if a material constitutes an onsite hazard.

Four types of hazardous material regulated by the DOT are tracked by SNL/NM. These include radioactive materials, chemicals, explosive materials, and fuels.

2.3.5.4 Chemical Materials Management and Control

The primary goal for managing and controlling chemicals at SNL/NM is to protect the health and safety of workers, the public, and the environment.

Chemical Materials

SNL/NM handles more than 25,000 chemical containers annually. Chemicals are designated as hazardous if they present either a physical or a health hazard as defined by the DOT and listed in 49 Code of Federal Regulations (CFR) §172.101. Chemicals are managed using

Hazardous Material

A material, including a hazardous substance, as defined by 49 Code of Federal Regulations (CFR) §171.8, that poses an unreasonable risk to health, safety, and property when transported or handled.

administrative and physical controls that are designed to minimize exposure to an identified hazard. Facilities that use and store chemicals are evaluated using SNL/NM's Integrated Safety, Environmental, and Emergency Management System for determining appropriate approaches to managing and controlling hazards.

Historic Chemical Materials Use

SNL/NM previously maintained inventories of hazardous chemicals at levels sufficient to meet immediate needs that could arise at any time. This involved economical bulk chemical purchases; however, this also led to the shelf life of some containers expiring before they could be used. These chemical procurement practices created legacy chemicals that had to be disposed of properly. Now, SNL/NM orders needed chemicals on a "just-in-time" basis.

Baseline Hazardous Chemical Materials Use

From 1990 through 1996, SNL/NM primarily tracked chemical inventories using the *CheMaster* System. This system was designed primarily to enable SNL/NM to meet the requirements of the *Emergency Planning Community Right-to-Know Act* (EPCRA), also known as *Superfund Amendments and Reauthorization Act*, *Title III* (SARA) (42 United States Code [U.S.C.] Section [§]11001). EPCRA requires a facility to generate an annual list documenting the presence of certain hazardous chemicals in quantities exceeding federally prescribed safety thresholds and providing the list to health officials in the state and local community.

SNL/NM is currently changing to a new chemical inventory tracking program known as the *Chemical Information System* (CIS). This system, a commercial program developed by AT&T, provides features not available with the former system that allow the tracking of individual containers and access to online chemical inventory data at any time. This system also interfaces more readily with other environment, safety, and health programs, including industrial hygiene, hazardous waste management, radioactive and mixed waste management, waste minimization, emergency preparedness, fire protection, and NEPA. For NEPA, the CIS provides essential information on the chemical inventory and is a necessary element for calculating potential health effects.

2.3.5.5 Explosive Material Management and Control

SNL/NM manages explosive material through the *Explosive Inventory System*, a comprehensive database that tracks explosives and explosive-containing devices and assemblies from acquisition through use, storage, reapplication, and transfer or disposal. It provides information on material composition, characteristics, shipping requirements, life-cycle cost, plan of use, and duration of ownership. This system includes an inventory of explosive material owned or controlled by SNL/NM line organizations.

2.3.5.6 Radioactive Material Management and Control

SNL/NM uses a two-fold approach to radioactive material management: reduce surplus legacy radioactive material inventories and manage current nuclear material inventories at mission-essential levels. Nuclear material is a subclass of radioactive material as defined by the *Atomic Energy Act of 1954* (AEA) (42 U.S.C. §2011). SNL/NM manages the three types of accountable nuclear material—special nuclear material, source material, and other nuclear material—through an inventory database known as the *Local Area Network Nuclear Material Accountability System (LANMAS)*. Other radioactive material (less than 1 percent by mass) located at SNL/NM is not tracked through this tracking system.

2.3.5.7 Waste Management and Operations

Waste Operations

This section generally describes waste operations that are not analyzed in detail, as noted in Section 2.3.5.

SNL/NM manages all wastes in accordance with applicable Federal, state, and local laws and regulations and DOE Orders. These wastes are primarily regulated by the EPA, the DOE, and the New Mexico Environment Department (NMED). All current waste operations are being implemented following SNL/NM policies established to ensure worker and public safety and compliant management of regulated waste. These policies clearly define waste acceptance and disposal criteria, limit the number of workers who handle wastes, provide appropriate waste-specific training, and centralize waste handling areas.

Hazardous Waste

Hazardous wastes managed at the HWMF include wastes regulated under *Resource Conservation and Recovery Act* (RCRA) (42 U.S.C. §6901) and wastes regulated under the *Toxic Substances Control Act* (TSCA) (15 U.S.C. §2601); other wastes managed at the HWMF including wastes not regulated by RCRA or TSCA, but still hazardous; certain other solid wastes; and some other wastes not accepted by the Solid Waste Transfer Facility (SWTF). The hazardous waste generated at SNL/NM is predominantly from experiments, testing, other R&D activities, and infrastructure fabrication and maintenance. Environmental restoration and D&D also generate hazardous waste. Hazardous waste generated at each facility is usually coordinated by that facility's waste management department, with the exception of waste from large projects focused on asbestos abatement, which is managed separately through subcontracts.

SNL/NM also manages small amounts of waste from other SNL or DOE operations, such as SNL's Advanced Materials Laboratory on the University of New Mexico campus in Albuquerque or the DOE's Albuquerque Operations Office.

Radioactive Waste

The RMWMF staff manages LLW, LLMW, TRU waste, and MTRU waste for SNL/NM. In general, LLW and LLMW are generated during laboratory experiments and component tests. TRU and MTRU wastes are generated from the use of small quantities of plutonium and other TRU isotopes in R&D or from experiments involving nuclear reactor operations, including cleanup of residuals during reactor tests. Additional small quantities of LLW can be received periodically from remote test facilities including Kauai, Hawaii; White Sands Missile Range, New Mexico; and Tonopah Test Range, Nevada. LLMW generated at Sandia National Laboratories/California has also been shipped to SNL/NM for management in accordance with an NMED compliance order issued under the *Federal Facility Compliance Act* (42 U.S.C. §6961). SNL/NM has also received TRU waste from the Lovelace Respiratory Research Institute, which is DOE-funded and located on KAFB (Section 6.2.6).

Radioactive Waste Categories

***Low-Level Waste (LLW)*—**Waste that contains radioactivity and is not classified as high-level waste, TRU waste, spent nuclear fuel, or byproduct tailings containing uranium or thorium from processed ore (as defined in Section 11[e][2] of the AEA [42 U.S.C. §2011]). Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as LLW, provided that the concentration of TRU is less than 100 nCi/g.

***Low-Level Mixed Waste (LLMW)*—**Waste that contains both hazardous waste under the RCRA (42 U.S.C. §6901) and source, special nuclear, or byproduct material subject to the AEA (42 U.S.C. §2011).

***Transuranic Waste (TRU)*—**Waste that contains more than 100 nCi of alpha-emitting TRU isotopes per gram of waste, with a half-life greater than 20 years, except for (a) high-level radioactive waste; (b) waste that the Secretary has determined, with concurrence of the Administrator, does not need the degree of isolation required by the disposal regulations; or (c) waste that the U.S. Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR Part 61.

***Mixed Transuranic Waste (MTRU)*—**TRU waste that contains hazardous waste, as defined and regulated under the RCRA (42 U.S.C. §6901).

2.3.5.8 Environmental Restoration

The ER Project is a phased project designed to identify, assess, and remediate contaminated DOE-owned or -operated facilities that have contamination from disposal sites, releases, or spills. The initial remedial assessment of SNL/NM sites was conducted under the Comprehensive Environmental Assessment and Response Program beginning in 1984 and ending in 1987. The assessment identified 117 potential release sites. By 1993, the number had increased to 219 potential release sites (including offsite locations). A Hazardous and Solid Waste Amendments (HSWA) module of the RCRA permit was issued in August 1993. As co-permittees, both SNL/NM and the DOE are responsible for compliance under the terms of the HSWA permit. The EPA Region 6 (Dallas, Texas) was the authorized permitting agency at the time of issuance, but beginning in January 1996, authority was transferred to the NMED. The terms, conditions, and schedule contained

Hazardous and Solid Waste Amendments (HWSA)

The HSWA were proposed in 1984 by the EPA as amendents to the RCRA (42 U.S.C. §6901). A very important aspect of HSWA requires that release of hazardous wastes or hazardous constituents from any solid waste management unit that is located on the site of a RCRA-permitted facility be cleaned up. The cleanup is required regardless of when the waste was placed in the unit or whether the unit was originally intended as a waste disposal unit. SNL/NM's HWSA module to the RCRA Part B permit includes provisions for corrective actions for all releases. It also contains a compliance schedule that governs the corrective action process.

in the original HSWA Part B permit are, and continue to be, the primary legal drivers for the ER Project. The remediation field activities under the ER Project are scheduled for completion in fiscal year (FY) 2002, with permit modification by FY 2004 to remove remediated sites from further action. Subsequent monitoring activities are scheduled for an additional 30 years. As of 1996, 153 sites remained for restoration or additional assessment. SNL/NM has proposed no further action for 100 of the 153 sites to the appropriate regulatory authority. The ER Project is currently the largest generator of regulated waste at SNL/NM. The project can potentially generate wastes of varying types due to the many kinds of material that have historically been handled at SNL/NM. For example, these wastes may consist of contaminated soils, debris, wastewater, and used personal protective equipment. The waste categories include LLW, LLMW, RCRA hazardous waste, TSCA waste, biohazardous waste (such as septic tank sludge), and nonhazardous waste. ER Project generated waste is processed through the HWMF, the RMWMF, or the SWTF. Once accumulated, sampled, and fully characterized, environmental restoration-generated waste is transferred to the appropriate SNL/NM waste management department for treatment, storage, and offsite disposal. The time frame for disposal of waste, once removed from a release site, can be months or years, depending on the time required for characterization and scheduling for shipment to disposal facilities.

In June 1996, SNL/NM submitted a request for a permit modification for a Corrective Action Management Unit (CAMU) designed to be a storage, treatment, and containment unit dedicated to ER Project-generated hazardous waste (SNL/NM 1997a). This unit will be located near the former Chemical Waste Landfill (a site scheduled for remediation and closure under a RCRA Closure Plan). SNL/NM security personnel will provide controlled access. The SNL/NM waste management departments will continue to manage waste generated by the ER Project, excluding hazardous waste designated for containment in the CAMU. The CAMU was approved in September 1997 by EPA Region 6. An environmental assessment was prepared for the ER Project at SNL/NM. It analyzes potential environmental effects of the characterization and waste cleanup or corrective action of environmental restoration sites (DOE 1996c). The impacts of the ER Project are incorporated into the analysis of the SWEIS.

2.3.5.9 Pollution Prevention and Waste Minimization

SNL/NM has implemented a Pollution Prevention Program to comply with DOE requirements. SNL/NM's Pollution Prevention Program applies to all pollutants generated by routine and nonroutine operations. It consists of activities that encourage pollution prevention or waste source reduction, recycling, resource and energy conservation, and procurement of EPA-designated recycled products.

2.3.5.10 Recycling

SNL/NM currently has recycling processes for plain paper, cardboard, used oil, scrap metal, batteries, fluorescent light bulbs, solvents, mercury, landscaping waste, aluminum cans, tires, and used toner cartridges. At present, all paper and corrugated paper recycled at SNL/NM are processed through the SWTF. In 1996, SNL/NM initiated a joint effort with LANL to collect, process, and market LANL-generated recyclable paper. After creating the process, the program was expanded to include the DOE/Kirtland Area Office. Over the next few years, efforts will continue to expand cooperation with other Federal and state facilities.

2.3.6 Selected Facilities

Following Chapter 2 are a series of facility descriptions that provide additional detail for all of the facilities that are named in Sections 2.3.4.1 through 2.3.4.6. They consist of a brief description of the location, hazard class (low-hazard nonnuclear), primary purpose, and the major types of activities performed at the facility. Also

Low-Hazard Nonnuclear

"Low-hazard nonnuclear" are facilities or project activities that have the potential for minor onsite impacts (within the boundaries of SNL/NM-controlled areas) and negligible offsite impacts (outside the boundaries of SNL/NM-controlled areas) to people or the environment. SNL/NM uses primary hazards screening (PHS) to identify hazards, hazard classifications, training requirements, and required safety documents. A "low-hazard nonnuclear" facility does not require additional safety documentation. Accelerators and reactors do not meet this definition and require additional safety documentation including safety assessments and safety analysis reports.

identified are the basic processes performed at the facility, the programs and activities currently being supported, the major categories of radioactive and hazardous materials used by the processes, and the types or radioactive and hazardous emissions or wastes generated by activities at the facility. For all of the facilities described here and for each of the three alternatives described in Chapter 3, the FSID (SNL/NM 1997b) contains more detail including the estimated quantities for the specific radioactive and hazardous chemicals used and emissions or waste generated by a facility's operations. All of these details were considered in completing the consequence analysis in Chapter 5.

FACILITY DESCRIPTIONS
TABLE OF CONTENTS – BY FACILITY TYPE

MANUFACTURING, R&D LABORATORIES, AND TESTING FACILITIES

PHYSICAL TESTING AND SIMULATION FACILITIES

ACCELERATOR FACILITIES

REACTOR FACILITIES

OUTDOOR TEST FACILITIES

SELECTED INFRASTRUCTURE FACILITIES

FACILITY DESCRIPTIONS
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NEUTRON GENERATOR FACILITY (NGF)

Function and Description:

The mission of the NGF, located in Technical Area-I, is to support the U.S. nuclear weapons program by fabricating neutron generators (external initiators for nuclear weapons), neutron tubes, and prototype switch tubes. This is a low-hazard, nonnuclear facility located in Building 870, a two-story structure with a basement, where most processing and assembly operations take place. The facility includes a special air handling system that captures tritium from operations that have the potential to release this material. The NGF is primarily an assembly facility that receives components, including the tritium-loaded target materials, from various sources. Final neutron generator assembly is conducted and devices are tested.

Specific Processes, Activities, and Capabilities:

A variety of techniques are used and highly specialized metal work is done to accomplish the following categories of processes:

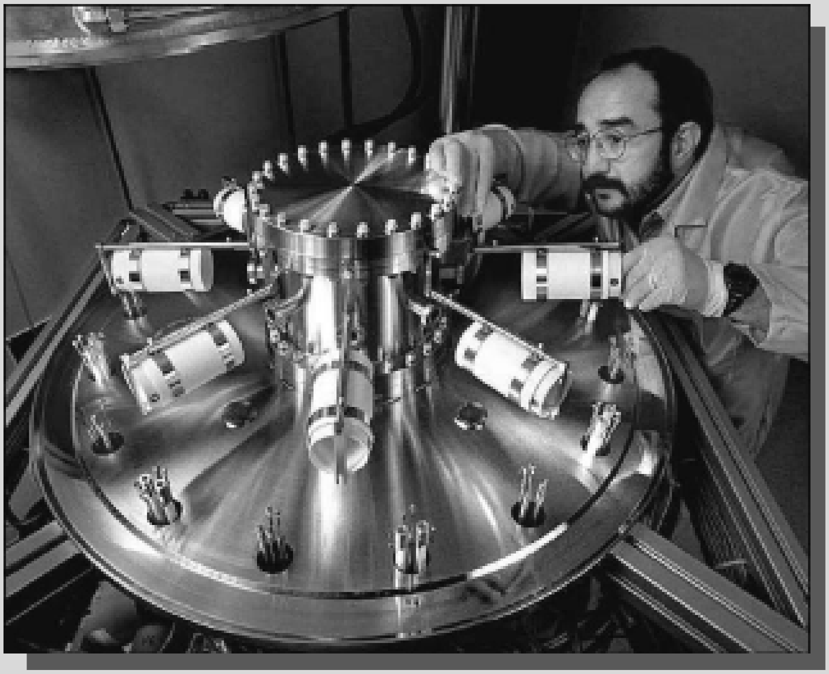
- preparing and coating the surfaces of components,
- joining and welding,
- encapsulating,
- fabricating and assembling, and
- inspecting and testing.

The NGF operations are allocated, but not limited, to the following programs and activities:

- Direct Stockpile Activities and Weapon Programs involve development of neutron generators.
- Technology Transfer develops processes with part and process suppliers.
- Production Support and Capability Assurance activities involve production of neutron generators including components.
- Other programs, include research and development, process development, and certification testing of neutron generators and components.

The production of neutron generators involves fabricating and assembling major components, including a neutron tube, miniature accelerator, power supply, and timer.

Potential tritium emissions are associated with various aspects of equipment calibration, destructive testing, outgassing of components, prototype development, manufacturing, and material handling. A variety of chemicals (corrosives, solvents, organics, and inorganics) in gaseous (including hydrogen), liquid, and solid forms in relatively small quantities are used in many of these specific processes. Chemical emissions, including corrosives, alcohols, ketones, and other solvents, are associated with various aspects of surface preparation, cleaning, material processing, manufacturing, testing, and quality control. Small sealed radioactive sources, nondestructive testing (X-rays), and lasers are used in the facility.



Source: SNL/NM 1998a

Figure FD–1. Neutron Generator Facility (NGF)

The NGF is used for fabricating neutron generators and prototype switch tabs. The neutron generator consists of a neutron tube and a power supply to operate it. The generation of neutrons is accomplished by the fusion of isotopes of hydrogen (deuterium and tritium) by ion acceleration.

MICROELECTRONICS DEVELOPMENT LABORATORY (MDL)

Function and Description:

The mission of the MDL, located in Building 858 in Technical Area-I, is to provide the microelectronics research and engineering capabilities to support industry, government, and other programs of national interest. The MDL contains 30,000 ft^2 of clean room, consisting of 22 independent bays separated by 8-ft-wide utility chases. Laboratory space outside the clean room area is used for wafer test equipment, die packaging, scanning electron microscopy, device radioactive source exposure, and device inspection. The basement of the facility contains acid waste neutralization equipment used in the neutralization of process wastewater. The MDL includes the Emergency Response Center, which has the equipment necessary to respond to facility emergencies.

Specific Processes, Activities, and Capabilities:

A variety of processes are used to produce microelectronic and micromechanical devices that may vary according to the needs of a particular project. These processes, however, can be grouped within the following four broad categories of iterative processes:

- Film deposition—processes that prepare the surface of a silicon chip with conductive and nonconductive layers and polymers.
- Photolithography—processes that transfer a larger master pattern of components onto the film layers, similar to photographic processes in concept.
- Etching—processes that carve out the image created on the films and that can expose selected portions of the surface of the silicon chip.
- Ion implantation—processes that place electrically active chemicals of various types into the exposed portions of the silicon chip surface.

MDL operations support the following types of programs and activities:

- Direct stockpile activities conduct research and development in microelectronics devices for nuclear weapon applications.
- Enhanced Surveillance Programs examine corrosion in select components.
- Technology Transfer and Education Programs develop microelectronic systems and processes.
- Advanced Manufacturing, Design and Production Technologies develop new processes and building prototypes.
- Weapons Programs activities develop microelectronic devices for weapon components.

Large quantities of acids and caustics and a wide variety of toxic and corrosive gases are used in clean rooms to clean, develop, and etch wafer surfaces and to create the films and chemical ions for implantation. While chemical quantities are less than those of a commercial manufacturing operation, the types of materials and chemicals used in these processes are generic to the semiconductor industry. Chemical air emissions occur during various points of the processes identified above, including the use or application of chemical developers and reactant liquids. Small sealed sources are also contained in equipment used in radiation hardening testing.

Source: SNL/NM 1998a

Figure FD–2. Microelectronics Development Laboratory (MDL)

The MDL was built in 1988 as a world-class facility dedicated to the advancement of microelectronic research, development, and application initiatives of strategic interest. Advanced manufacturing technologies can be tested at the MDL. Here, this worker wears a special uniform to protect microcircuits from lint and dust.

ADVANCED MANUFACTURING PROCESSES LABORATORY (AMPL)

Function and Description:

The mission of the AMPL, located in Technical Area-I, is to develop and apply advanced manufacturing technology to produce products in support of Sandia National Laboratories/New Mexico's national security missions. The AMPL, comprised of 11 laboratories or divisions, can prototype and do limited manufacture of many of the specialized components of nuclear weapons. The advanced manufacturing technology development in the AMPL is focused on enhancing capabilities in four broad areas: manufacture of engineering hardware, emergency and specialized production of weapon hardware, development of robust manufacturing processes, and design and fabrication of unique production equipment.

Specific Processes, Activities, and Capabilities:

The activities conducted in the AMPL are typically laboratory and small-scale manufacturing operations involving materials and process research. The equipment used is commercial or custom-built laboratory and small-scale instrumentation. Operations range from standard wet chemistry to high-tech chemical techniques. Operations include, but are not limited to, development of processes and applications using plastics and organics, nonexplosive powders, adhesives, potting compounds, ceramics, laminates, microcircuits, lasers, machine shop equipment, electronic fabrication, multichip modules, thin-film brazing and deposition, and plating and glass technology.

AMPL operations support the following types of programs and activities:

- Direct stockpile activities program develops and applies advanced processes for nuclear weapon applications.
- System Components Science and Technology Program supports materials processing needs of Defense Programs (metals, polymers, ceramics, and galss).
- Technology Transfer and Education Programs develop advanced manufacuring processes through coordination with industrial partners.
- Production Support and Capability Assurance Program activities develop and produce active ceramic components for neutron generators.
- Advanced Manufacturing, Design, and Production Technologies develop and improve processes for weapon production.
- Work for other Federal Agencies, Private Corporations, and Institutions develop advanced manufacturing techniques and processes, electronics, materials, and systems.

These activities involve the use of a variety of chemicals (including corrosives, solvents, organics, inorganics, and gases) in relatively small amounts. All activities are perfromed in well-ventilated areas or fume hoods to prevent employee exposure. Most of the wastes generated in these activities are spent solvents, corrosives, and inert purge gases (such as nitrogen and helium). Neutron generators and other related components containing tritium are handled at the AMPL; however, the tritium contained in these components is completely sealed within a welded tube. No radioactive air emissions are produced at this facility.

Source: SNL/NM 1998a

Figure FD–3. Advanced Manufacturing Processes Laboratory (AMPL)

Activities at the AMPL include development of weapons hardware and design of production equipment.

INTEGRATED MATERIALS RESEARCH LABORATORY (IMRL)

Function and Description:

The mission of the IMRL, located in Technical Area-I, is to conduct materials and advanced components research. The IMRL facility is a 140,000-ft^2, multiple-story facility, which develops new and superior materials to meet the needs of government and private industry. This low-hazard, nonnuclear facility houses most of the advanced materials research and development functions at Sandia National Laboratories/New Mexico (SNL/NM). These research activities include laboratory studies in chemistry, physics, and alternative energy technologies. Experimental work is augmented by advanced computer modeling and simulation techniques, another SNL/NM area of expertise.

Specific Processes, Activities, and Capabilities:

IMRL research and development efforts are focused on meeting multiple program management objectives through manufacturing process development and integration of new and advanced products with advanced process development. In process development, IMRL concentrates on materials and processes to support long-term stockpile needs for limited-life components. In material sciences, work includes scientifically tailoring materials, studying defects, and researching impurities in materials.

Numerous techniques and highly specialized processes are developed to improve light gas membranes, improve fuel and chemical production, and develop thin films (each a few angstroms thick). These thin films include mixtures of semiconductors to enhance electronic and optical properties not exhibited in purer form. Thin-film techniques include depositing chemicals (in vapor form) to surfaces to reduce friction, corrosion, and wear and enhance performance of materials like superconductors and optical materials.

To accomplish these tasks, IMRL uses electron microscopy for analytical and high resolution imaging and an electron microprobe to analyze very small structures. Also IMRL uses X-ray diffraction, X-ray fluorescence, and vibrational spectroscopy for surface and material analysis especially for material defects along with computer-aided design, synthesis, characterization, and testing. A variety of operations are carried out involving laser, electron beam, pulsed, and inertial welding equipment designed to join different types of metals. Small-lot fabrication of foams and membranes are also made. Synthesis of novel polymers, experimental and theoretical studies on polymer degradation, and catalysis development and improved material separation to reduce impurities and defects are accomplished using numerous analytical techniques including dielectric and ferroelectric testing, electrooptic characterization, and ultra-fast optical spectroscopy.

IMRL operations support the following types of programs and activities:

- Advanced Industrial Materials Research Program conducts materials research and development.
- Catalysis and Separations Science and Engineering chemistry and materials research and development.
- Materials Processing by Design.
- Materials Sciences uses advanced characterization instrumentation for research into relationships between materials properties and structure, and development of new and favorable material properties through advanced synthesis and nanoscale structuring of materials.
- Advanced Design and Production Technologies develops and characterizes advanced materials and production processes.

- Direct Stockpile Activities conducts research and development of engineered materials for nuclear weapon applications.

- Technology Transfer and Education Activities conduct materials development and testing in conjunction with industry partners in technology development.

A variety of chemicals (corrosives, solvents, organics, and inorganics) in gaseous (including hydrogen), liquid, and solid forms in relatively small quantities are used in many of these specific processes. Chemical air emissions, including corrosives, alcohols, ketones, and other solvents, are associated with various aspects of surface preparation, cleaning, material processing, manufacturing, testing, and quality control. Small sealed radioactive sources, nondestructive testing (X-rays), and lasers are used in the facility.

Source: SNL/NM 1998a

Figure FD–4. Integrated Materials Research Laboratory (IMRL)

Various weapons materials are tested at the IMRL.

EXPLOSIVE COMPONENTS FACILITY (ECF)

Function and Description:

The mission of the ECF, located just outside and to the south of Technical Area (TA)-I, is to conduct research and development on a variety of energetic components. The facility comprises a main building (Building 905) and six explosives storage magazines (Buildings 905A through F). The ECF consolidates a number of activities formerly conducted in TA-II related to energetic component research, testing, and development. The ECF is a low-hazard, nonnuclear, state-of-the-art facility.

Specific Processes, Activities, and Capabilities:

The ECF is primarily a test facility performing the following activities:

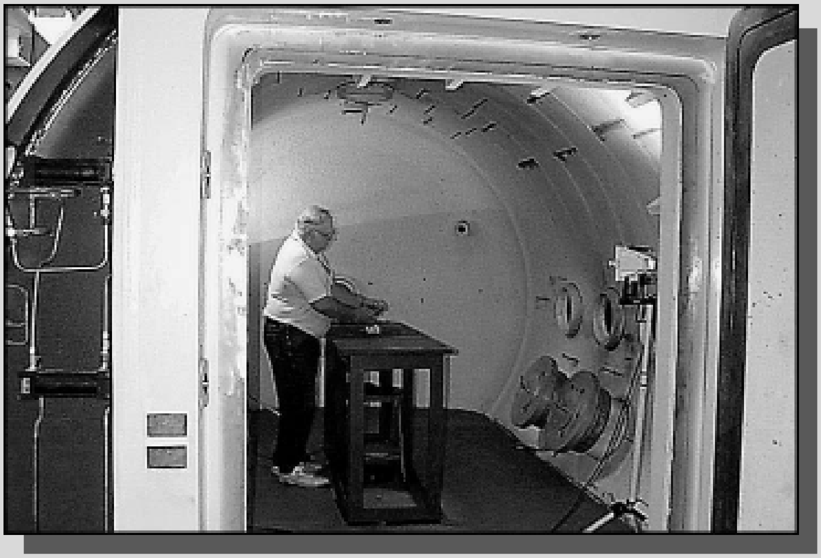
- physical and chemical testing of explosives, pyrotechnics, and propellants;
- development of advanced explosive components;
- research, development, and testing of neutron-generating devices;
- research, development, and testing of batteries; and
- stockpile surveillance of explosives, pyrotechnics, and propellants.

The ECF operations are allocated, but not limited, to the following programs and activities:

- Direct Stockpile Activities involve research and development (R&D), energetic materials, and other components.
- Special projects, conducted with the U.S. Department of Defense, include projects for the purpose of reducing operational hazards associated with energetic materials, advanced initiation and fuse development, and material studies along with computer simulation.
- Other projects involve a wide variety of experimental testing, R&D, analyses, technology transfer, and technology development related to explosives, explosive materials, explosive components, and other materials.

A broad range of energetic-material R&D and application activities are conducted at the ECF. Advanced diagnostic equipment is used during experiments ranging from 1 kg tests to sophisticated spectroscopic studies on milligram-size samples that probe fundamental processes of detonation.

A variety of chemicals (corrosives, solvents, organics, and inorganics) in gaseous, liquid, and solid forms in relatively small quantities are used in many different processes. Air emissions result from the use of corrosives, alcohols, ketones, and other solvents. Sealed radioactive sources, X-rays, and lasers are used in the facility. Low-level tritium emissions are associated with various aspects of neutron generator development and testing.



Source: SNL/NM 1998a

Figure FD–5. Explosive Components Facility (ECF)

SNL/NM's new 91,000-ft² ECF is a U.S. Department of Energy-designated user facility and makes state-of-the-art testing and evaluation capabilities available to industry.

TERMINAL BALLISTICS COMPLEX

Function and Description:

The mission of the Terminal Ballistics Complex, located in Technical Area-III, is to conduct environmental, safety, and survivability testing for nuclear weapon applications. The Terminal Ballistics Complex is a low-hazard facility that includes a main building (Building 6750), two smaller buildings (Buildings 6752 and 6753), and four explosive storage magazines. Building 6750 houses a small machine shop, office space, a control area, and an indoor firing range. Building 6753 is used for large propellant charge assembly and temperature conditioning of propellants. Building 6752 is an unoccupied storage shed for nonhazardous materials. The storage magazines are used for long-term storage of propellants and explosives.

Specific Processes, Activities, and Capabilities:

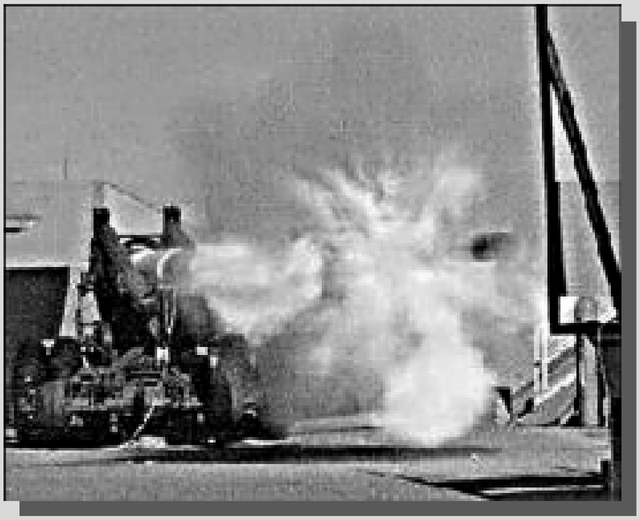
Processes at the Terminal Ballistics Complex are centered on the evaluation of test materials, primarily the physical examination, cleaning, and general quality assurance of munitions and components. In addition, the Terminal Ballistics Complex provides unique test environments and capabilities including the following:

- an outdoor, large-caliber gun range with a 155-mm “Long Tom” artillery gun permanently mounted in a revetment;
- static-fire rocket stands used to measure the thrust force of small rockets;
- test environments for ballistic studies and solid-fuel rocket motor tests; and
- secure, remote indoor and outdoor test facilities.

The Terminal Ballistics Complex operations are allocated, but not limited, to the following programs and activities:

- Direct Stockpile Activities, include development and survivability testing of nuclear weapon subsystems and components by using firearms and projectiles to determine material effects and responses.
- Special projects reduce operational hazards associated with explosives, explosive initiators, hard target penetration, computer simulation.
- Science and Technology include material response evaluations.
- Other projects include experiments on shipping containers and storage facilities.

The Terminal Ballistics Complex maintains a small chemical inventory and no radioactive material inventory. Various aspects of the preparation and evaluation of test materials can result in emissions from a variety of solvents including alcohols and ketones. Radioactive air emissions are not produced at this facility.



Source: SNL/NM 1998a

Figure FD–6. Terminal Ballistics Complex

At the Terminal Ballistic Complex's outdoor firing range, a 155-mm "Long Tom" gun fires a projectile.

DROP/IMPACT COMPLEX

Function and Description:

The mission of the Drop/Impact Complex, located in Technical Area-III, is to conduct hard-surface impacts, water impacts, and underwater tests of weapon shapes, substructures, and components. This work is performed to verify design integrity and performance and fuzing functions performance. Such tests help ensure that the nation's nuclear weapons systems meet the highest standards of safety and reliability. This is a low-hazard, nonnuclear facility consisting of two towers: a 185-ft drop tower next to a hard surface and a 300-ft drop tower next to a water-filled pool, 120 ft wide, 188 ft long, and 50 ft deep. A 600-ft-long rocket sled track is located at the end of the pool opposite the tower for testing rocket pull-down accelerated impacts into the water pool.

Specific Processes, Activities, and Capabilities:

The Drop/Impact Complex is primarily a test facility with operations that include conducting drop tests, rocket pull-down tests, submersion tests, and underwater explosive effects tests. Testing involves the following processes and support activities:

- receiving, storing, and handling explosives; pyrotechnics; propellants; nuclear radioactive, and chemical materials;
- setting up explosive tests, explosive arming and firing, explosives ordnance disposal;
- testing electronic instrumentation and data recording, photometrics, and telemetry;
- conducting hazard area control and checking fire-control system support;
- transporting test assemblies to test sites, rocket arming and launching, post-launch and firing procedures, diving operations; and
- recovering radioactive and chemical material.

The Drop/Impact Complex operations are allocated, but not limited, to the following programs and activities.

- Direct Stockpile Activities conduct environmental, safety, and survivability testing for nuclear weapon systems and components.
- Science and Technology activities involve testing of materials, components, and weapon systems.
- Model Validation efforts involve high-velocity impact testing on hard surfaces, water impact tests, and underwater tests to validate models.
- Other projects include testing prototype nuclear materials packaging, and other projects not associated with the U.S. Department of Energy.

During a drop test, a test object is dropped from the top of the tower for gravity acceleration to a hard impact surface. In a water test, objects are dropped from the top of the tower by gravity or rockets are used to boost acceleration.

The Drop/Impact Complex contains a small chemical inventory and no radioactive material inventory. Cleaners, lubricants, solvents, paints, and agents are used in small quantities. Compressed gases are used in the assembly areas, including acetylene and oxygen (for welding), argon, and helium. Chemical emissions, including alcohols, ketones, and other solvents, are possible and are associated with various aspects of surface preparation, cleaning, and material processing including quality control. Small amounts of airborne emissions, including carbon monoxide and lead, are released during explosives tests. Although the most common radioactive material used is depleted uranium, other nuclear and radioactive materials associated with test objects may include uranium alloys, thorium alloys and compounds, and tritium. Radioactive air emissions are not produced at this facility.

Source: SNL/NM 1998a

Figure FD–7. Drop/Impact Complex

The Drop/Impact Complex is used to conduct hard-surface and water impact tests.

SLED TRACK COMPLEX

Function and Description:

The Sled Track Complex, located in Technical Area-III, supports the verification of design integrity, performance, and fuzing functions of weapon systems through the simulation of high-speed impacts of weapon shapes, substructures, and components. Sandia National Laboratories/New Mexico (SNL/NM) test facilities such as the Sled Track Complex have been specifically designed for the validation of analytical modeling and the functional certification of weapons systems. The facility is also used to subject weapon parachute systems to aerodynamic loads to verify parachute design integrity and performance. In addition, SNL/NM Energy & Environment Programs use the Sled Track Complex to verify designs in transportation technology, reactor safety, and Defense Programs transportation systems.

Specific Processes, Activities, and Capabilities:

Operations at the Sled Track Complex include a variety of tests and test article preparation such as conducting rocket sled and rocket launcher tests, free-flight testing, and explosive testing. Each rocket sled test involves the acceleration of a rocket down a sled track. A test may involve impacting an object onto a target, or launching a parachute from an ejector accelerated along the track. Each explosive detonation is used to subject test articles to shock waves and propel missiles into test articles. Rocket launches are used to accelerate test objects along a beam on a carriage that is stopped at the end of the beam, releasing test objects into free flight at specific targets. In free-flight launches, test objects are launched directly into free flight from portable launch rails.

These operations also include:

- receiving, storing, and handling explosives; pyrotechnics; propellants; and nuclear, radioactive, and chemical materials;
- fabricating and assembling rocket sleds including payloads and rockets;
- setting up explosive tests, electronic instrumentation, and data recording and special equipment including lasers, tracking equipment, and X-ray;
- reducing hazards through area, systems, and personnel control;
- disposing of explosives ordnance; and
- recovering radioactive and chemical materials.

Specific programs and activities supported by the Sled Track Complex include, but are not limited to, the following:

- Direct Stockpile Activities and Performance Assessment and Technology Programs conduct environmental, safety, and survivability testing for nuclear weapon applications.
- Energy Programs certify designs in transportation technology and reactor programs.
- Work for Other Federal Agencies in impact, functional, and explosives effects testing.

Small amounts of chemicals are maintained for use in assembling rocket sleds and test payloads in Buildings 6741, 6743, and 6736. For example, various adhesives and epoxies are used to fasten transducers and similar items. Cleaners, lubricants, solvents, paints, and other such agents may also be used in small quantities. Compressed gases are used in the assembly areas, including acetylene and oxygen (for welding), argon, and helium; and dry nitrogen and carbon dioxide are used for pneumatic actuators.

Source: SNL/NM 1998a

FD–8. Sled Track Complex

One of the more unique testing sites available for use at SNL/NM is a high-speed sled track used for rocket sled and launcher testing, free-flight testing, and explosive testing.

CENTRIFUGE COMPLEX

Function and Description:

The Centrifuge Complex, located in Technical Area-III, is used to validate analytical models and to certify the functioning of large test objects under high acceleration conditions. The complex is also used to certify designs in transportation technology. The Centrifuge Complex has been classified a low-hazard, nonnuclear facility. Typical test objects in the Centrifuge Complex include weapons systems, satellite systems, reentry vehicles, geotectonic loads, rocket components, and sensing devices.

Specific Processes, Activities, and Capabilities:

Test preparation processes include machine shop welding operations, surface treatments, welding, and other means to attach parts. Test objects are attached to one end of a boom that rotates around a central shaft. Counterweights are attached to the other end of the boom to counterbalance the test objects. Hydraulic drive motors rotate the central shaft and boom to the revolutions per minute required to achieve the test acceleration. Other tests involve combining vibration and acceleration of oversized or hazardous test objects, including explosive payloads. Sometimes a centrifuge is used to accelerate small objects to high velocity with subsequent release to impact on targets. The Centrifuge Complex has two centrifuge units.

- The 29-ft indoor centrifuge, located inside Building 6526, can subject test objects weighing up to 16,000 lb to 100 times the acceleration of gravity (100 *g*). An acceleration of 300 *g* can be achieved with proportionally lighter test objects.

- The 35-ft outdoor centrifuge, located adjacent to Building 6526, can subject test objects weighing up to 10,000 lb to an acceleration of 45 *g*. An acceleration of 240 *g* can be achieved with proportionally lighter test objects.

Each centrifuge test involves subjecting a test object to a specified level of acceleration for a specified duration. In each impact test, a small object is accelerated and released from the arm of the 35-ft centrifuge on a tangential trajectory to impact targets.

The Centrifuge Complex operation are allocated, but not limited, to the following programs and activities:

- Direct stockpile activities include survivability testing of nuclear weapon systems and components.

- Energy Programs conduct certification testing of transportation systems through impact tests.

- Other programs test satellite systems.

The Centrifuge Complex contains a small chemical inventory but no radioactive materials. Cleaners, lubricants, solvents, paints, and agents are used in small quantities. Compressed gases used in the assembly areas include acetylene and oxygen (for welding), argon, and helium. Chemical emissions, including alcohols, ketones, and other solvents, are associated with various aspects of surface preparation, cleaning, and material processing including quality control. Small amounts of airborne emissions, including carbon monoxide and lead, are released during explosives tests. Radioactive air emissions are not produced at this facility. Noise from centrifuge operation, collision impacts, and explosive testing does occur. Fragments resulting from centrifuge-launched explosives are recovered shortly after test events.

Source: SNL/NM 1998a

FD–9. Centrifuge Complex

This 35-ft outdoor centrifuge can test objects weighing up to 10,000 lb to an acceleration of 45 g.

SATURN ACCELERATOR

Function and Description:

The mission of the SATURN accelerator, located in Building 981 in Technical Area-IV, is to conduct development and survivability testing of nuclear weapon subsystems and components. SATURN was designed and built to provide X-ray radiation environments with enhanced simulation fidelity as well as providing improved test exposure levels and test areas. SATURN can also operate in a plasma radiation source configuration, generating ultra-high intensity soft X-ray environments. The SATURN facility consists of a laboratory building (including a high bay, office space, shop areas, light laboratories, a mechanical room, a radiation exposure cell, and a basement) and storage tanks and transfer systems for large quantities of transformer oil and deionized water.

The accelerator is a symmetric, parallel-current driver consisting of 36 identical pulse-compression and power-flow modules arranged like the spokes of a wheel. It can easily be configured to drive either annular electron beam or Z-pinch loads. The pulsed-power components are housed in an open-air tank that is 96 ft in diameter and 14 ft high. The tank is divided into energy storage, pulse compression, power flow, and power combination sections. The concrete- and earth-shielded exposure cell is located in a basement room beneath the accelerator.

Specific Processes, Activities, and Capabilities:

Activities in the SATURN involve testing the survivability of nuclear weapon systems by simulating the X-rays produced by a nuclear weapon detonation. SATURN is used to simulate the effects of nuclear countermeasures on electronic and material components, as a pulsed-power and radiation source, and as a diagnostic test bed for accelerator component development. This work would include, but not be limited to, improvements or changes to energy storage systems, pulse-forming systems, voltage conditioning networks, and other accelerator components. The SATURN accelerator is designed as a modular, high-power, variable-spectrum, X-ray simulation source that can be operated with two different X-ray controllers or any one of several plasma radiation sources.

Areas of application include the following:

- satellite systems;
- electronic and materials devices, components, and subsystems; and
- reentry vehicle and missile subsystems.

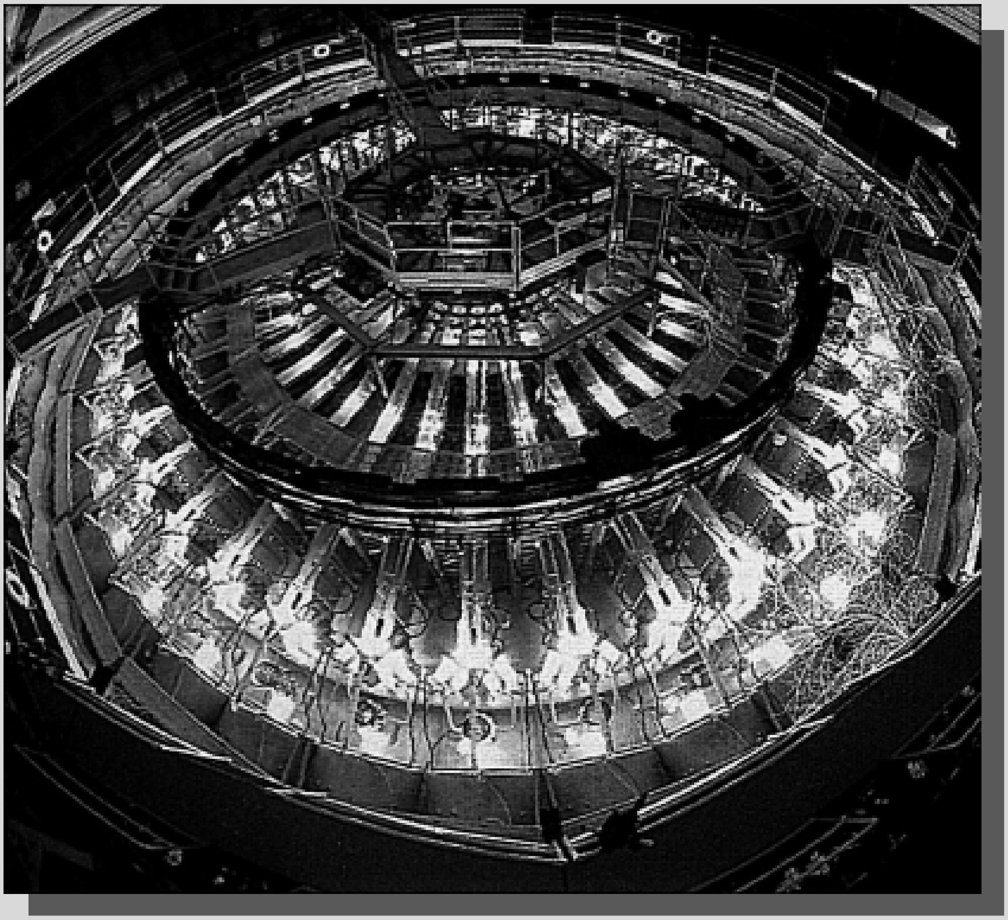
SATURN facility operations are allocated, but not limited, to the following programs and activities:

- Direct Stockpile Activities conduct development and survivability testing of nuclear weapons subsystems and components by simulating the X-ray radiation effects of nuclear weapons on nonnuclear components of U.S. Strategic Systems.
- Testing of satellite systems.
- Strategic Defense Initiative tests space assets, reentry vehicles, and missile subsystems.
- Inertial Confinement Fusion Programs involves Z-pinch plasma tests and weapons physics research.

The SATURN facility contains a small chemical inventory and a small radioactive material inventory. Chemical emissions, including alcohols, ketones, and other solvents, are possible and are associated with various aspects of surface preparation, cleaning, and material processing including quality control. Sulfur hexafluoride is used as the insulator gas in switching components. Sulfur hexafluoride gas is passed through switches under continuous pressure. It is hazardous in enclosed areas because it does not support respiration. Some tests involve the installation of beryllium filters or shields that can be damaged during a shot, causing release of beryllium particulates. Radioactive air emissions are not produced at this facility. Small sealed radioactive sources (calibration and monitoring), nondestructive testing (X-rays), and lasers are used in the facility.

Accelerator Hazards:

All areas of the facility have access control maintained by fences and gates with locking mechanisms, physical inspection, and clearing processes. In addition, confinement barriers are provided to protect personnel and equipment from the effects of any generalized radiation or electromagnetic fields produced by the operation of the accelerator.



Source: SNL/NM 1998a

FD–10. SATURN Accelerator

The SATURN accelerator is a modular, high-power, variable-spectrum, X-ray simulation source. SATURN is used to simulate the radiation effects of nuclear countermeasures on electronic and material components, as a pulsed-power and radiation source, and as a diagnostic test bed.

HIGH-ENERGY RADIATION MEGAVOLT ELECTRON SOURCE UNIT III (HERMES III)

Function and Description:

HERMES III, a major facility in the Simulation Technology Laboratory (STL), Building 970, is a short-pulse (20- to 30-nsec), high-energy (20-MeV) accelerator that was designed and built to provide intense gamma ray fields over very large areas. This testing provides very realistic conditions associated with some aspects of a nuclear explosion radiation environment. The radiation can be used to test the response of electronics, weapon system components, and entire systems. The accelerator can also be reconfigured to accelerate light ions.

The 55,000-ft^2 (5,110-m^2) HERMES III facility includes the accelerator, indoor and outdoor test cells, and ancillary support systems, including oil storage tanks. The heavily shielded indoor test cell, which is used for most tests, has a usable test area 25 ft deep by 37 ft wide, and can support a load of 100 lb/ft^2, which makes it suitable for testing of most parts and components. The unique shielded outdoor test cell allows testing of large assemblies and entire weapon systems or a variety of other large systems such as tanks.

Specific Processes, Activities, and Capabilities:

Gamma rays are created by discharging the energy storage systems in a manner that increases their voltage. Then, intermediate storage systems and transmission lines add voltage and form a pulse, and a diode section generates an electron beam and converts the beam into gamma rays. The diode section can also be configured to generate a variety of light ion beams and associated ionizing and nonionizing radiation depending on the type of ion accelerated, the target material, and radioactive decay mode. Objects to be irradiated are placed in either the indoor or outdoor test cells and the radiation environment created by operating the accelerator is tailored to the needs of the test.

HERMES III operations support the following types of programs and activities:

- Direct Stockpile Activities conduct the development and survivability testing of nuclear weapon subsystems and components.
- Experimental Activities in radiation testing and associated diagnostics determine the deleterious or beneficial effects of radiation on electronic, material, and biological systems.
- Inertial Confinement Fusion Program activities validate advanced hydrodynamic radiography techniques and applications to address stockpile stewardship issues on the compact, cost-effective, multi-axis Advanced Hydrotest Facility expected to be located at Los Alamos National Laboratory.
- Performance Assessment Science and Technology Program supports hostile (radiation) environmental testing of weapon components.
- Pulsed-Power Technology Program activities support new pulsed-power components and designs involving modifications to the HERMES III machine for pulsed-power research, development, testing, and evaluation.

A large amount of transformer oil is used as an insulator in the energy storage sections of the facility, but only small amounts of hazardous chemicals, such as solvents, are used. Inert gases are used in switching devices and stored in the facility in sufficient quantities to warrant controls for asphysixiant hazards. Lasers are used to align accelerator components and in switching mechanisms. Radioactive air emissions may be generated by activation of oxygen or nitrogen in air while operating in the gamma ray production mode, particularly with outdoor shots; however, these emissions are at very low levels and decay within seconds.

Accelerator Hazards:

All areas of the facility have access control maintained by fences and gates with locking mechanisms, physical inspection, and clearing processes. In addition, confinement barriers are provided to protect personnel and equipment from the effects of any generalized radiation or electromagnetic fields produced by the operation of the accelerator.

Source: SNL/NM 1998a

FD–11. High-Energy Radiation Megavolt Electron Source Unit III (HERMES III)

The HERMES III accelerator is the world's most powerful gamma simulator. It is used primarily for simulating the effects of prompt radiation for a nuclear burst on electronics and complete military systems.

SANDIA ACCELERATOR & BEAM RESEARCH EXPERIMENT (SABRE)

Function and Description:

The mission of the SABRE pulsed accelerator, located in Building 970 in Technical Area-IV, is to support the Inertial Confinement Fusion (ICF) Program for advanced extraction ion controller research and for target and focusing studies. The accelerator can also be configured for radiography experiments and used as the driver that provides a flash radiography source. SABRE is a pulsed accelerator located within the Simulation Technology Laboratory (STL), along with the High-Energy Radiation Megavolt Electron Source Unit III (HERMES III) accelerator and, soon to be constructed, the Radiographic Integrated Test Stand (RITS) accelerator. The SABRE is comprised of the accelerator itself, a lead- and concrete-shielded test cell, a basement trench where the diode capacitor banks are located, and several screen rooms and work areas located nearby.

Specific Processes, Activities, and Capabilities:

For the ICF Program, the SABRE is the workhorse of the light ion program for investigating extraction diodes and magnetically insulated transmission line coupling; for testing surface and subsurface cleaning, improved vacuum conditions, and advanced ion sources; and for studying lithium ion transport. It uses the inductive voltage adder technology also used on the HERMES III. New high-magnetic-field capability was tested in fiscal year 1996 as part of the Advanced Hydrodynamic Radiography Program in the Sandia National Laboratories/New Mexico Pulsed-Power Sciences. For Stockpile Support activities in testing weapons components, test objects are placed within the accelerator test cell and irradiated by the accelerator-produced radiation. Afterwards, the test objects are examined to determine their survivability from exposure to radiation.

Areas of application include

- computer science,
- simulation of X-rays and gamma rays produced by a nuclear weapon detonation,
- flight dynamics,
- satellite processing, and
- robotics.

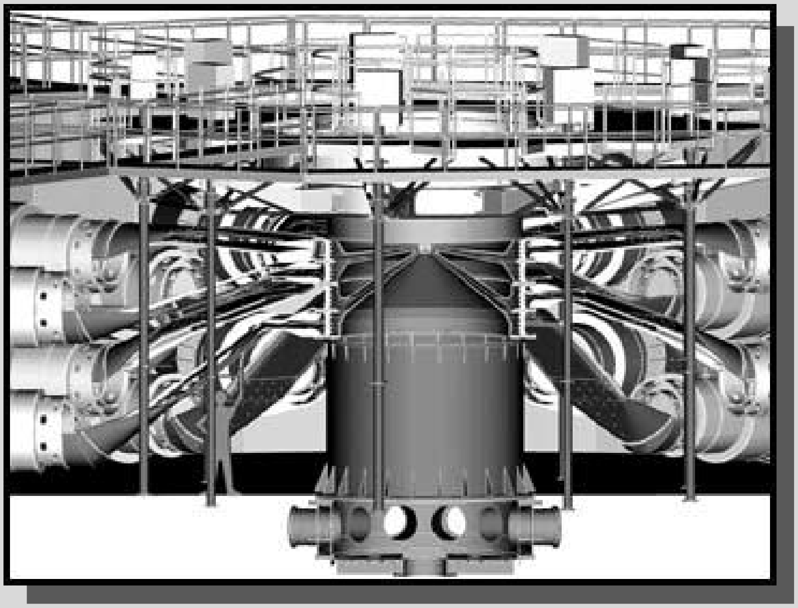
SABRE operations are allocated, but not limited, to the following programs and activities:

- Direct Stockpile Activities, include survivability testing of nuclear weapon subsystems and components.
- Performance Assessment Science and Technology Program supports developing pulsed-power technology to provide advanced radiographic characterization techniques useful to applications such as Dual-Axis Radiographic Hydrotesting.
- Inertial Confinement Fusion Program involves light-ion program activities, lithium ion transport, and high-magnetic field testing.

The SABRE facility contains a small chemical inventory and a small radioactive material inventory. Chemical emissions, including alcohols, ketones, and other solvents, are possible and are associated with various aspects of surface preparation, cleaning, and material processing, including quality control. Radioactive air emissions are not produced at this facility. Small, sealed radioactive sources (calibration and monitoring), nondestructive testing (X-rays), and lasers are used in the facility.

Accelerator Hazards:

All areas of the facility have access control maintained by fences and gates with locking mechanisms, physical inspection, and clearing processes. In addition, confinement barriers are provided to protect personnel and equipment from the effects of any generalized radiation or electromagnetic fields produced by the operation of the accelerator.



Source: SNL/NM 1998a

FD–12. Sandia Accelerator & Beam Research Experiment (SABRE)

The SABRE is located in TA-IV and is used to support the ICF Program.

SHORT-PULSE HIGH INTENSITY NANOSECOND X-RADIATOR (SPHINX)

Function and Description:

The mission of the SPHINX facility, located in Building 981 in Technical Area-IV, is to provide radiation environments for testing components of nuclear weapons and for confirming codes used in the certification of nuclear weapons components. Because of the moratorium on underground nuclear testing, the nuclear stockpile integrity must be assured by various simulation testing including computer modeling. The SABRE creates a radiation environment used to validate computer simulations and verify stockpile integrity. The SPHINX accelerator is a high-voltage, high-shot-rate X-ray and electron beam accelerator that is used primarily to measure X-ray–induced photo currents from short, fast-rise-time pulses in integrated circuits and associated heat handling response in materials. The facility, including a concrete-shielded enclosure adjacent to the SATURN accelerator in Building 981, consists of an 18-stage, low-inductance generator; several pulse conduits; and radiation barriers.

Specific Processes, Activities, and Capabilities:

The SPHINX is used primarily as a research facility. The operations and activities taking place in the SPHINX are diverse, although the dominant activity is related to pulsed-power technology. SPHINX is applied as a high-shot-rate, hot–X-ray–effects simulator capable of testing piece parts or components that require small-area exposure. The SPHINX can operate in two distinct modes: as an X-ray source and as an electron beam source. In the X-ray source mode, researchers study the response of electronics to pulsed high-energy X-ray environments. The electron beam mode is used to study the heat handling response of materials to pulsed radiation. It has high usage to support development work in tactical, strategic satellite systems.

Areas of application include

- computer science,
- simulation of X-rays and gamma rays produced by a nuclear weapon detonation,
- flight dynamics,
- satellite processing, and
- robotics.

SPHINX operations are allocated, but not limited, to support to the following programs and activities:

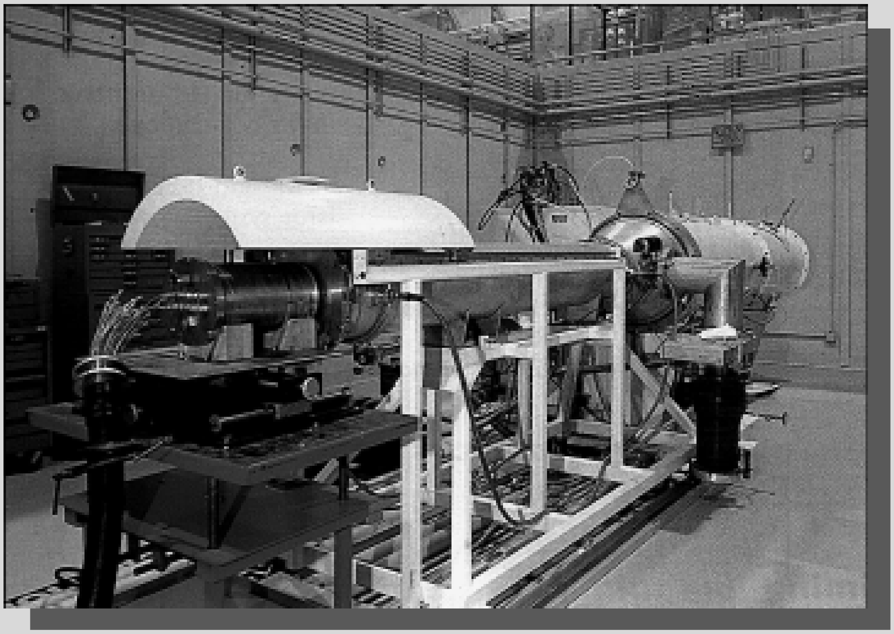
- Experimental activities involve testing with high-shot-rate (accelerator firings) and simulating hot X-ray effects for testing of parts and components.
- Performance Assessment Science and Technology Program applications provide high intensity X-ray and electron beam sources for weapons effects studies.
- Studies on the thermostructural response of materials to pulsed radiation.

- Tactical and strategic satellite systems development work.
- Various research and development work for other Federal agencies using SPHINX facility capabilities.

The SPHINX facility contains a small chemical inventory and no radioactive material inventory. Chemical emissions, including alcohols, ketones, and other solvents, are possible and are associated with various aspects of surface preparation, cleaning, and material processing, including quality control. Radioactive air emissions are not produced at this facility.

Accelerator Hazards:

All areas of the facility have access control maintained by fences and gates with locking mechanisms, physical inspection, and clearing processes. In addition, confinement barriers are provided to protect personnel and equipment from the effects of any generalized radiation or electromagnetic fields produced by the operation of the accelerator.



Source: SNL/NM 1998a

FD–13. Short-Pulse High Intensity Nanosecond X-Radiator (SPHINX)

The SPHINX is a new addition to SNL/NM radiation facilities and was placed in operation in 1992.
SPHINX is primarily used to measure the X-ray–induced photocurrents from short, fast-rise-time pulses in integrated circuits.

RHEPP I

REPETITIVE HIGH ENERGY PULSED-POWER UNIT I (RHEPP I)

Function and Description:

The mission of the RHEPP I accelerator, located in Building 986 in Technical Area-IV, is to serve as a tool for the technology development of continuous-operation, pulsed-power systems to demonstrate high-energy ion beams and industrial pulsed-power applications. The RHEPP I facility includes a high-energy generator; computer-controlled, pulsed-power equipment; specialized voltage enhancement equipment; specialized electrical current control and storage equipment; and a material test chamber for ion source testing and development. The electrical current control equipment and materials test chamber are located in a below-grade, radiation-shielded test cell under the voltage-enhancement equipment.

Specific Processes, Activities, and Capabilities:

The RHEPP I is primarily a research facility. Its operations and activities are diverse, although the dominant activity is related to pulsed-power technology. During normal operation, the RHEPP systems produces pulses of electrons that may be stopped, converted to ions, or extracted, depending upon the configuration of the accelerator. The RHEPP I was the first Sandia National Laboratories/New Mexico (SNL/NM) accelerator used for the basic technology development of the RHEPP technical concept. It is now used for applications at lower energies and for technology development and some experimental work with materials and organic sterilization processes. Testing in RHEPP I includes exposing test materials (metals and plastics) located in the test cell to shots of proton energy generated by the accelerator. Test objects are then evaluated to determine the effects of the low-level radiation. A new activity for the RHEPP I would be to use ion beams to melt and resolidify near-surface material on small amounts of depleted uranium.

Areas of application include

- computer science,
- simulation of the X-rays and gamma rays produced by a nuclear weapon detonation,
- flight dynamics,
- satellite processing, and
- robotics.

RHEPP I operations support the following types of programs and activities:

- Nonproliferation and Verification Research and Development Program design of advanced accelerators for applications related to the defeat of biological (nonpathenogenic) and chemical agents.
- Performance Assessment Science and Technology Program develops unique pulsed-power materials-processing techniques for weapons applications.
- Pulsed-Power Technology Program technology development and related experimental activities.

The RHEPP I facility contains a small chemical inventory and a small radioactive material inventory. Chemical emissions, including alcohols, ketones, and other solvents, are possible and are associated with various aspects of surface preparation, cleaning, and material processing, including quality control. Radioactive air emissions are not produced at this facility.

Accelerator Hazards:

All areas of the facility have access control maintained by fences and gates with locking mechanisms, physical inspection, and clearing processes. In addition, confinement barriers are provided to protect personnel and equipment from the effects of any generalized radiation or electromagnetic fields produced by the operation of the accelerator.

Source: SNL/NM 1998a

FD–14. Repetitive High Energy Pulsed-Power Unit I (RHEPP I)

The RHEPP I facility is an operational test bed for the development of technology used to melt and resolidify metals and ceramics for a variety of potential industrial applications.

REPETITIVE HIGH ENERGY PULSED-POWER UNIT II (RHEPP II)

Function and Description:

The mission of the RHEPP II accelerator, located in Building 963 in Technical Area-IV, is the development of radiation processing applications using high-dose-rate electron or X-ray beams. The RHEPP II accelerator is also a test center for the continued development of high-power magnetic switches and repetitive magnetically insulated transmission lines.

The RHEPP II facility contains the RHEPP II accelerator and the additional components of the microsecond pulse compressor, water-insulated pulse equipment, voltage enhancement equipment, and a high-power electron beam controller.

Specific Processes, Activities, and Capabilities:

The RHEPP II is primarily a research facility in the area of pulsed-power technology. It is used for basic magnetic switching technology development and as a U.S. Department of Energy (DOE) user facility for high-energy-per-pulse applications. RHEPP technology has been used for ion beam surface treatment to harden material surfaces and for advanced research supporting sterilization projects for organic materials (for example, food products and lumber). Testing in RHEPP II includes exposing test materials in the test cell to high doses of X-rays to both simulate the conditions of nuclear weapon detonation as well as the effects of outer space on satellite components. While RHEPP I testing is confined largely to the surface of materials, RHEPP II produces an X-ray environment used to irradiate the entire test material.

Areas of application include

- computer science,
- simulation of the X-rays and gamma rays produced by a nuclear weapon detonation,
- flight dynamics,
- satellite processing,
- commercial application and technology transfer, and
- robotics.

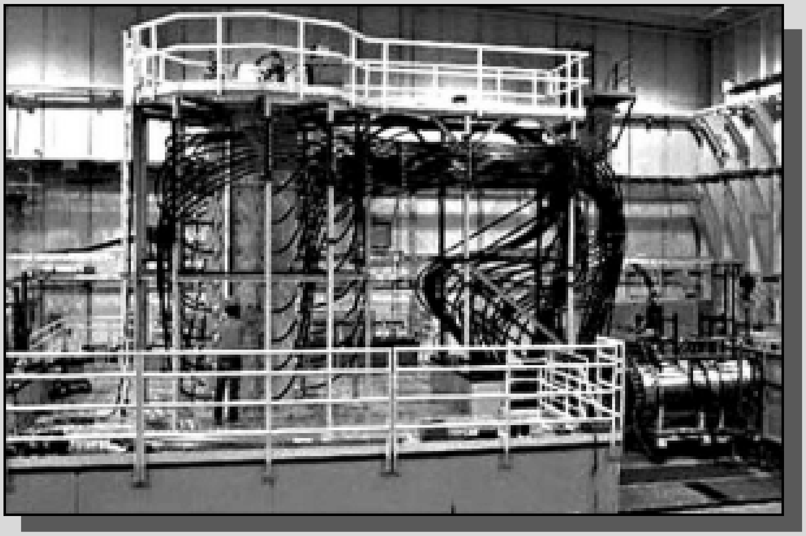
RHEPP II operations support the following types of programs and activities:

- Performance Assessment Science and Technology Program develops pulsed-power technologies and applications for DOE Defense Programs and work for other Federal agencies.
- Initiatives for Proliferation Prevention Program and Nonproliferation and Verification Research and Development Program activities involve developing advanced accelerators for biosterilization of such items as food and lumber, mentioned earlier.
- Pulsed-Power Technology Program activities involve basic switching technology development, high-energy pulse applications, ion-beam surface treatment for hardened materials, advanced research in support of the programs mentioned above, and the sterilization of organic materials.

The RHEPP II facility contains a small chemical inventory and no radioactive material inventory. Chemical emissions, including alcohols, ketones, and other solvents, are possible and are associated with various aspects of surface preparation, cleaning, and material processing, including quality control. Radioactive air emissions are not produced at this facility.

Accelerator Hazards:

All areas of the facility have access control maintained by fences and gates with locking mechanisms, physical inspection, and clearing processes. In addition, confinement barriers are provided to protect personnel and equipment from the effects of any generalized radiation or electromagnetic fields produced by the operation of the accelerator.



Source: SNL/NM 1998a

FD–15. Repetitive High Energy Pulsed-Power Unit II (RHEPP II)

RHEPP II, which began operation in July 1994, is a modular accelerator capable of operation up to 300 kW. Scheduled experiments include food pasteurization studies and direct bonding of ceramics.

Z-MACHINE

Function and Description:

The mission of the Z-Machine facility, formerly known as the Particle Beam Fusion Accelerator II (PBFA II) and located in Building 983 in Technical Area-IV, primarily provides weapons systems survivability testing by simulating the X-rays produced by nuclear weapon detonation.

The Z-Machine facility includes the accelerator high bay, support area high bays, laser and facility support systems including water and oil tank farms, low bay light laboratories, and the control room. The Z-Machine consists of 36 modules arranged radially around a central experiment vacuum chamber. The accelerator is located in a tank approximately 108 ft in diameter and 20 ft high, divided into 3 annular regions.

Specific Processes, Activities, and Capabilities:

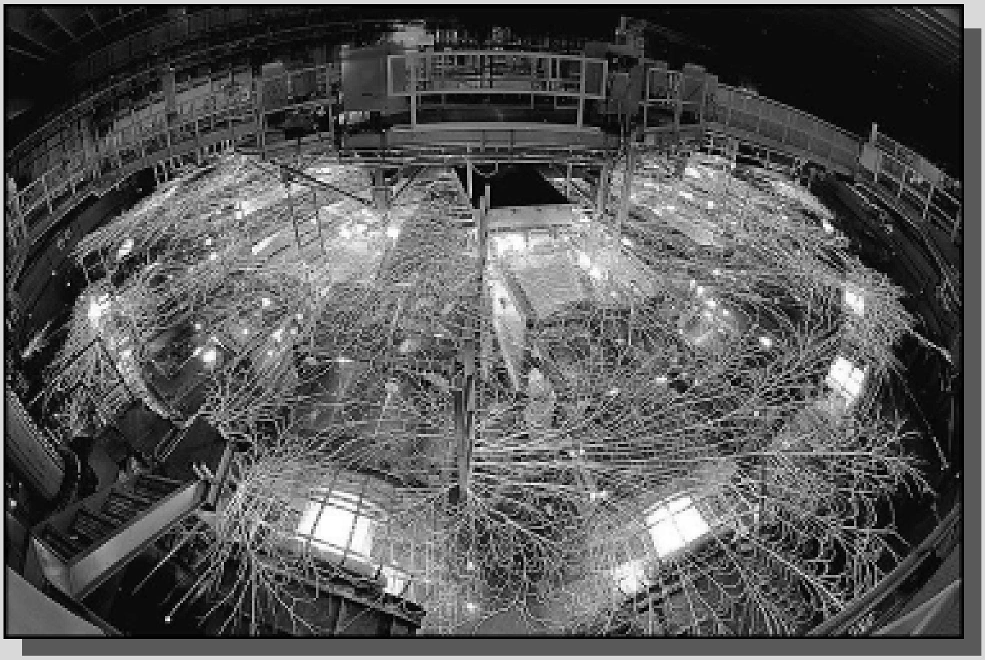
Operating on the principle of pulsed-power, the Z-Machine stores electrical energy over a period of minutes then releases that energy in a concentrated burst. The accelerator produces a single, extremely short, extremely powerful pulse of energy that can be focused on a target. The primary operating mode of the Z-Machine produces a pulse that lasts 100 nsec with approximately 5 MJ of electrical energy and a peak power of 50 TW. Materials are not irradiated within the Z-Machine, but rather the accelerator provides a radiation environment used to validate computer modeling of the effects of certain X-rays on weapons components. Experiments at the facility are primarily research and development in nature.

Z-Machine operations are allocated, but not limited, to accelerator shots, or firings, in support of the following types of programs and activities:

- Performance Assessment Science and Technology Program develops advanced pulsed-power sources for weapons effects testing and weapons physics experiments.
- Inertial Confinement Fusion (ICF) Program studies involve pulse-shaping, radiation flow, equation of state and opacity measurements, hydrodynamic instabilities, capsule implosion physics, and the production of thermonuclear neutrons using deuterium.
- Continued Advanced Pulsed-Power Technology Program tests provide high-temperature, large-volume hohlraums and cold X-ray environments for weapons physics and ICF applications.

Accelerator Hazards:

All areas of the facility have access control maintained by fences and gates with locking mechanisms, physical inspection, and clearing processes. In addition, confinement barriers are provided to protect personnel and equipment from the effects of any generalized radiation or electromagnetic fields produced by the operation of the accelerator.



Source: SNL/NM 1998a

FD–16. Z-Machine

Raw Power: Time exposure photography of electrical discharges illuminating the surface of the Z-Machine, the world's most powerful X-ray source, during a recent accelerator shot.

TERA-ELECTRON VOLT ENERGY SUPERCONDUCTING LINEAR ACCELERATOR (TESLA)

Function and Description:

The mission of the TESLA facility, located in Building 961 in Technical Area-IV, is to test plasma-opening switches for pulsed-power drivers. The TESLA accelerator facility includes the accelerator high bay, light laboratories, offices, and the screen room. The facility is contained in a rectangular tank, 25 ft wide by 14 ft long by 10 ft high, with a vacuum chamber extension represented by two coaxial cylinders. The TESLA test cell includes electrical charge storage, a magnetically controlled plasma-opening switch, and electron beam storage. The oil tank contains 10,000 gals of transformer oil and a generator, which can store a maximum of 740 kJ in 48 capacitors and is equipped with a mechanical shorting system. The water tank contains 15,000 gals of deionized water and a 150-kilojoule intermediate storage capacitor. Two-foot-thick concrete block walls surround the test cell.

Specific Processes, Activities, and Capabilities:

The electron beam storage consists of an electron diode with a graphite converter. Testing at TESLA is primarily focused on evaluating improvements to pulsed-power technology and not on irradiating materials. The maximum possible voltage is 5 MV into a very high impedance load.

TESLA operations support, but are not limited to, the following types of programs and activities:

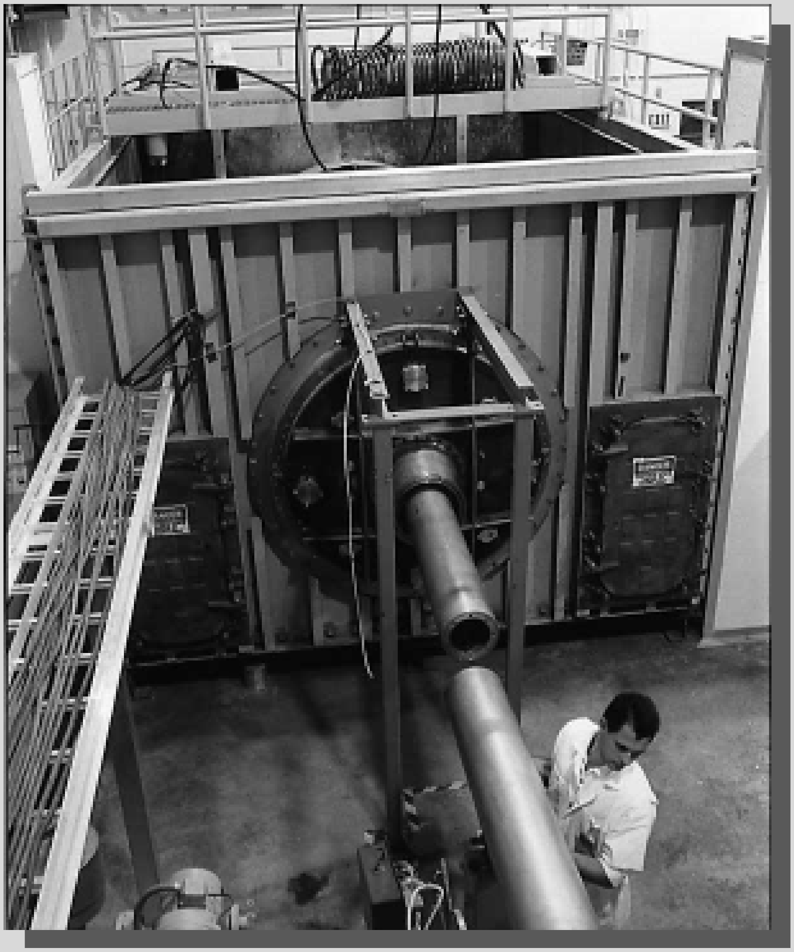
- Pulsed-Power Technology Program activities including radiation-producing shots (electron-beam into carbon load) and pulsed-power shots into dummy loads (shots that do not produce radiation).

- Performance Assessment Science and Technology Program activities dedicated to advanced pulsed-power development.

The TESLA facility contains a small chemical inventory and no radioactive material inventory. Chemical emissions, including alcohols, ketones, and other solvents, are possible and are associated with various aspects of surface preparation, cleaning, and material processing, including quality control. Radioactive air emissions are not produced at this facility.

Accelerator Hazards:

All areas of the facility have access control maintained by fences and gates with locking mechanisms, physical inspection, and clearing processes. In addition, confinement barriers are provided to protect personnel and equipment from the effects of any generalized radiation or electromagnetic fields produced by the operation of the accelerator.



Source: SNL/NM 1998a

FD–17. Tera-Electron Volt Energy Superconducting Linear Accelerator (TESLA)

The TESLA facility is used to test switches for pulsed-power drivers.

ADVANCED PULSED-POWER RESEARCH MODULE (APPRM)

Function and Description:

The mission of the APPRM, located in the Building 963 in Technical Area-IV, is to evaluate the performance of new pulsed-power components and component alignments to improve the performance of future accelerators. The APPRM is a relatively small, single-pulse accelerator that serves as a test center for other scientific projects and can be used for conducting general pulsed-power research. Pulsed-power technology being tested at the APPRM is a potential candidate technology for future accelerator development beyond Sandia National Laboratories/New Mexico's (SNL/NM's) Z-Machine.

Specific Processes, Activities, and Capabilities:

The operations and activities taking place in the APPRM are diverse, although the dominant activity is related to pulsed-power technology. APPRM is primarily used as a test bed for investigating physical design and pulsed-power issues associated with future accelerator design. None of the research involves the use of radioactive materials. Even in the "full system" configuration of the accelerator, the activation of materials from firing the accelerator is negligible.

Areas of application include

- computer science,
- simulation of X-rays and gamma rays produced by a nuclear weapon detonation,
- flight dynamics,
- satellite processing, and
- robotics.

APPRM operations support the following types of programs and activities:

- Experimental programs develop pulsed-power modules designed to study power storage, high-voltage switching, power flow for advanced applications, and advanced technologies in support of new designs.
- Performance Assessment Science and Technology Program develops pulsed-power sources for future incorporation into pulsed-power machines designed for weapons effects and weapons physics experiments.
- Inertial Confinement Fusion Program activities are similar to a gas switch design that eliminates the shock generated in the module and is useful to designs of future pulsed-power facilities such as the X-1 accelerator, for which the APPRM is the design prototype.

The APPRM facility contains a small chemical inventory and no radioactive material inventory. Chemical emissions, including alcohols, ketones, and other solvents, are possible and are associated with various aspects of surface preparation, cleaning, and material processing including quality control. Radioactive air emissions are not produced at this facility.

Accelerator Hazards:

All areas of the facility have access control maintained by fences and gates with locking mechanisms, physical inspection, and clearing processes. In addition, confinement barriers are provided to protect personnel and equipment from the effects of any generalized radiation or electromagnetic fields produced by the operation of the accelerator.

Source: SNL/NM 1998a

FD–18. Advanced Pulsed-Power Research Module (APPRM)

Pulsed-power components are evaluated at the APPRM.

RADIOGRAPHIC INTEGRATED TEST STAND (RITS)

Function and Description:

The RITS is a proposed new accelerator that would be installed in the Technical Area (TA)-IV, Building 970, high bay. The purpose of this new accelerator, planned for fiscal year 1999, would be to demonstrate voltage enhancement technology utility for advanced water influenced radiography. The RITS would be an intense electron beam test center bed and would be used to develop and demonstrate the capabilities required for the national Advanced Hydrotest Facility (AHF). The AHF would provide experimental benchmarking for advanced full-physics, three-dimensional numerical models of nuclear weapon primaries. The resulting confidence in the codes would form the basis for confidence in the nuclear performance and safety of the enduring stockpile and provide critical data to qualify remanufacture technologies and lifecycle engineering.

Specific Processes, Activities, and Capabilities:

The operations and activities of the RITS would be diverse, although the dominant activity would be related to pulsed-power technology. Other research that the RITS would support includes validation of pulse-power architecture (power flow), equipment physics studies, weapons code validation, diagnostic development, and possible long-range research involving explosive component testing. The X-rays would be used to radiograph both static and dynamic (explosively driven) objects within the Building 970 high bay. Under future programs, explosive testing could be conducted within the accelerator test cell. Such explosive tests would be conducted using an approved explosive containment system that could handle explosive charges up to 30 lb of trinitrotoluene (TNT) equivalent.

Areas of application include

- computer science,
- simulation of the X-rays and gamma rays produced by a nuclear weapon detonation,
- flight dynamics,
- satellite processing,
- commercial application and technology transfer, and
- robotics.

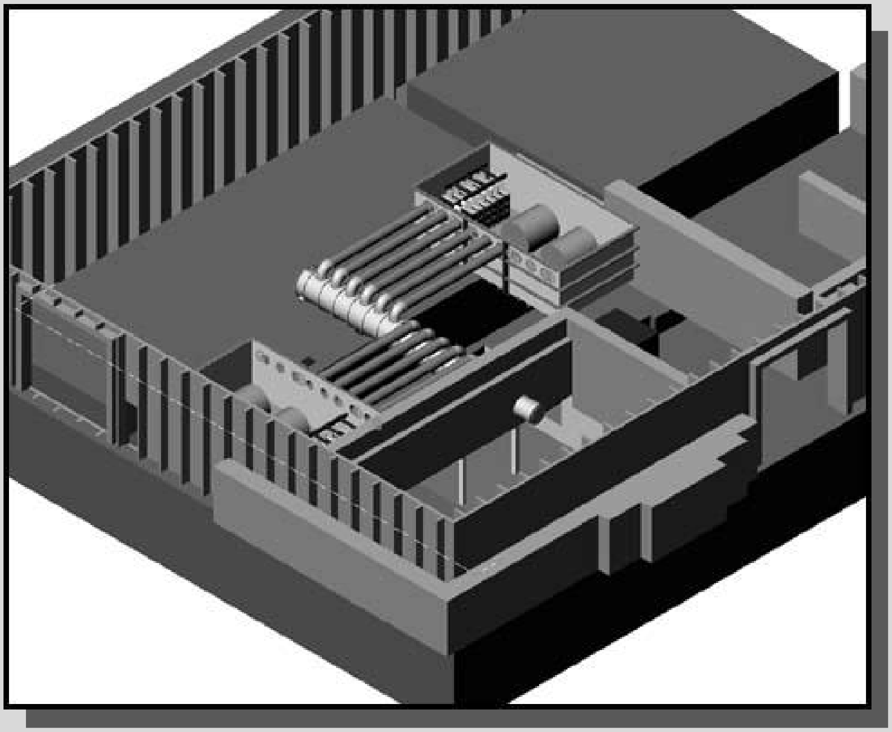
As planned, RITS operations would initially support the following Assistant Secretary for Defense Program activities:

- Radiography of both static and dynamic objects, including explosives tests in containment systems.
- Research into validating pulse-power architecture (power flow), diode physics studies, weapons code validation, and system diagnostic development.

The RITS facility would contain a small chemical inventory and a small radioactive hardware inventory. This hardware would become radioactive through high-energy activation during tests. Chemical emissions, including alcohols, ketones, and other solvents, would be possible and would be associated with various aspects of surface preparation, cleaning, and material processing including quality control. Radioactive air emissions would be produced when the energy releases during a test.

Accelerator Hazards:

All areas of the facility would have access control maintained by fences and gates with locking mechanisms, physical inspection, and clearing processes. In addition, confinement barriers would be provided to protect personnel and equipment from the effects of any generalized radiation or electromagnetic fields produced by the operation of the accelerator.



Source: SNL/NM 1998a

FD–19. Radiographic Integrated Test Stand (RITS)

The RITS is a proposed accelerator to replace the existing Proto II accelerator.

NEW GAMMA IRRADIATION FACILITY (NGIF)

Function and Description:

The mission of the NGIF, located in Technical Area (TA)-V, is to provide test cells for the irradiation of experiments with high-intensity gamma ray sources. Currently under construction, the NGIF will be a single-story structure located in the northeast area of TA-V. The main features of the NGIF will be the deep water pool and two dry irradiation cells. The facility will include a special air handling system, water recirculation system, and water makeup subsystem to maintain optimal operational conditions and to prevent the potential release of materials. The pool will be able to store up to 2.4 MCi of cobalt-60 or an equivalent source (40 kw) of other gamma-ray sources. The sources will be in the form of pins and could be shared between in-cell irradiation facilities and in-pool irradiation facilities. Ancillary spaces in the high bay will include offices, setup/light laboratories, and restrooms.

The NGIF consolidates several existing Sandia National Laboratories/New Mexico (SNL/NM) gamma sources into a single facility. The planned facility could include sources relocated from the existing Gamma Irradiation Facility, which is a two-cell dry irradiator located in the Annular Core Research Reactor (ACRR) high bay in TA-V. The NGIF would also include gamma sources relocated from the low-intensity cobalt array, which is located in SNL/NM's TA-I. This would consolidate gamma irradiation sources in a single dedicated facility in a remote area, reducing the potential for radiation exposure of nonoperations personnel. The main hazard associated with the facility would be the potential for inadvertent exposure of operations personnel to the high-intensity radioactive sources.

Specific Processes, Activities, and Capabilities:

Testing in the NGIF facility would include irradiation of test packages in one of the available test cells for 13,000 test hours per year (approximately 26 weeks continuous irradiation in each of 3 cells). The key consumable resources in the NGIF facility would be the radioisotope sources that provide the gamma radiation necessary to conduct the tests. The radioactivity of these radioisotope sources would diminish over time regardless of whether or not tests were being conducted. The NGIF has been designed for highly specialized high-intensity gamma ray source experiment work.

Areas of application include

- thermal and radiation effects studies,
- degradation testing of weapon components,
- material and component testing for nuclear reactor accident tests,
- electronic component certification and testing
- survivability and certification tests for military and commercial applications,
- radiation effects on material properties,
- radiation effects on organic materials (such as food or sludge),
- hazardous waste destruction, and
- mixed environment testing (such as steam and radiation or heat and radiation).

The NGIF facility would contain a small chemical inventory and no radioactive material inventory. Chemical emissions, including alcohols, ketones, and other solvents, would be possible and would be associated with various aspects of surface preparation, cleaning, and material processing, including quality control. Radioactive air emissions would not be produced at this facility.

Source: SNL/NM 1998a

FD–20. New Gamma Irradiation Facility (NGIF)

The three new cells being developed at the NGIF would allow complete systems to be tested during irradiating experiments.

GAMMA IRRADIATION FACILITY (GIF)

Function and Description:

The mission of the GIF, located in Technical Area-V, is to provide test cells for the irradiation of experiments with high-intensity gamma ray sources. The GIF facility shares the high bay with the Annular Core Research Reactor (ACRR) in Building 6588 and includes a deep water pool and two dry irradiation cells. The pool is a rectangular, reinforced concrete structure with a stainless steel liner, approximately 8 ft wide by 14.5 ft long by 16 ft deep. The facility also includes a special air handling system, water recirculation system, and water makeup subsystem to maintain optimal operational conditions and to prevent the potential release of materials. The main hazard associated with the facility is the potential for inadvertent exposure of operations personnel to the high-intensity radioactive sources.

Specific Processes, Activities, and Capabilities:

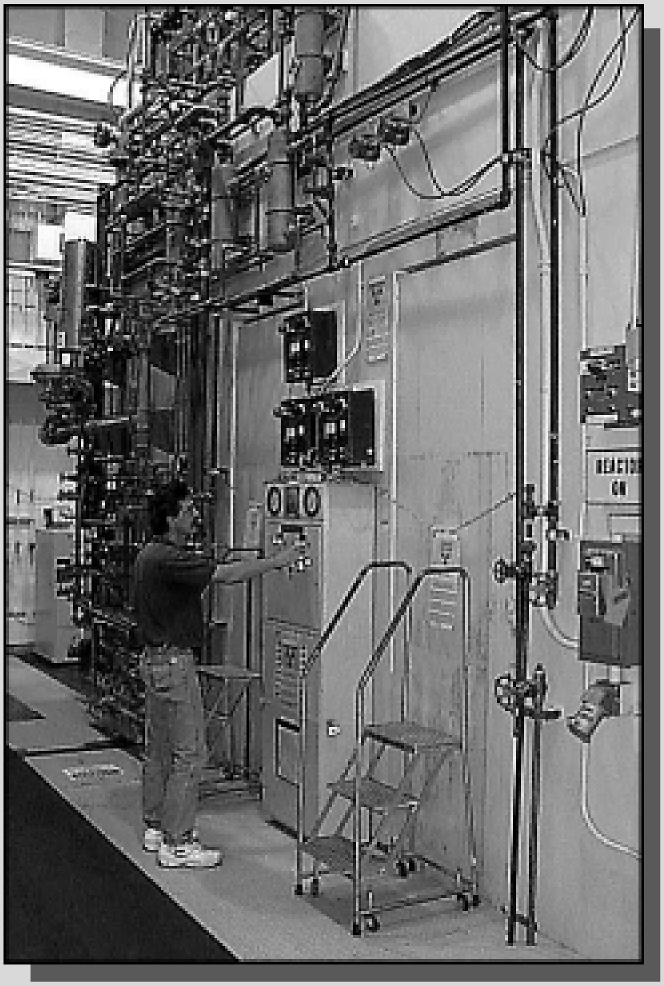
Testing in the GIF facility includes irradiation of test packages in one of the two available test cells for 1,000 test-hours (approximately 40 days of continuous irradiation in each of the two cells) per year. Current plans call for test hours to reach zero by 2003 as the New Gamma Irradiation Facility begins operation. The key consumable resource in the GIF is the radioisotope sources that provide the gamma radiation necessary to conduct the tests. The radioactivity of the radioisotope sources diminishes over time regardless of whether or not tests are being conducted. The GIF is designed for highly specialized high-intensity gamma ray source experiment work.

Areas of application include

- radiation testing of electronic components in satellite and weapon systems,
- dosimetry calibration,
- studies of radiation damage to materials,
- hostile (gamma radiation) environmental testing,
- underwater transfer of material from the reactor to transfer casks, and
- reactor fuel and other radioactive components storage.

The radioactive sources that the GIF uses are pins of cobalt-60, which are sealed in stainless steel cladding with welded end caps. Stainless steel is used as cladding because of its high strength and resistance to corrosion in water. The GIF inventory of sources includes 107 pins of cobalt-60 with a total strength of 109,100 Ci.

The GIF facility contains a small chemical inventory and no radioactive material inventory. Chemical emissions, including alcohols, ketones, and other solvents are possible and are associated with various aspects of surface preparation, cleaning, and material processing, including quality control. Radioactive air emissions are not produced at this facility.



Source: SNL/NM 1998a

FD–25. Gamma Irradiation Facility (GIF)

The GIF provides two cobalt cells for total dose irradiation environments and is used mainly for radiation certification of satellite and weapons systems electronic components, dosimetry calibration, and radiation damage to materials studies.

SANDIA PULSED REACTOR (SPR)

Function and Description:

The mission of the SPR, which includes the fast-burst reactors SPR II and SPR III, is to provide unique near-fission spectrum radiation environments for testing a wide variety of technologies that support both defense and nondefense activities. The facility, located in Technical Area-V, produces high-neutron fluence or pulsed high-neutron doses for the testing of electronic subsystems and components.

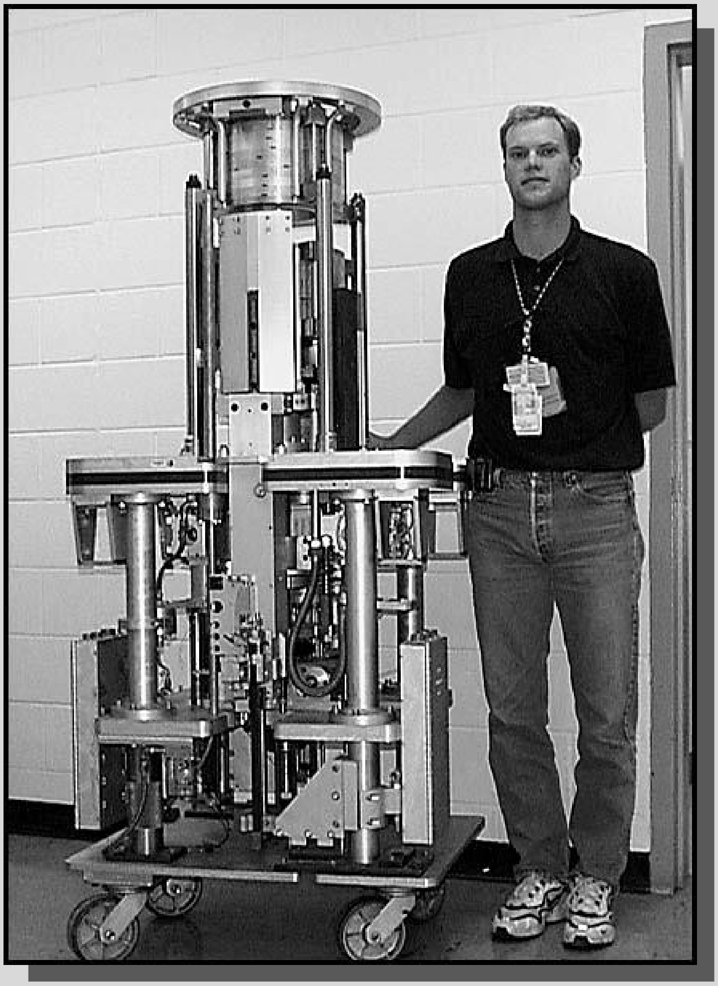
The SPR facility is located in the reactor building, a large, thick-walled, steel-reinforced concrete structure referred to as the Kiva. It is cylindrical, with an outside diameter of about 39 ft, covered with a hemispherical shell. Access to the reactor building is provided by a concrete and steel door, which remains closed for most operations. Experiment support facilities, including the reactor maintenance building and the instrument rooms, are adjacent to the reactor building. Also, several storage vaults, which are integral units in adjacent buildings, are available for the storage of the reactor and fissionable and radioactive materials.

Specific Processes, Activities, and Capabilities:

SPR III uses an unmoderated cylindrical assembly of solid uranium metal, enriched to 93 percent uranium-235 with 10 weight-percent molybdenum. SPR III can be operated at steady-state power levels; however, the capability of the nitrogen cooling system and administrative restrictions effectively limit power and total energy generated in a given period. Normally, steady-state power operations are limited to a maximum of 10 kw, although higher power levels can be achieved.

The SPR facility currently houses the SPR-II and SPR-III and is used for reactor critical experiments. Also, SPR provides a source of pulsed high-energy radiation to simulate neutron and gamma radiation effects and provide data for certifying weapons and components for hostile environments. SPR-II and SPR-III are designed to produce a neutron spectrum very similar to the fission spectrum. The primary experiment chambers are central cavities that extend through the cores. Experiments may also be placed around the reactors. Beam ports are used to transport neutron flows outside the Kiva for other experimental needs.

The SPR facility contains a small chemical inventory and a radioactive nuclear material inventory. Chemical emissions, including alcohols, ketones, and other solvents, are possible and are associated with various aspects of surface preparation, cleaning, and material processing including quality control. Radioactive air emissions are produced at this facility when the energy releases during a test interact with air and produce argon-41. Small sealed radioactive sources are used for calibration and monitoring in the facility.



Source: SNL/NM 1998a

FD–24. Sandia Pulsed Reactor (SPR)

The Sandia Pulse Reactors II and III (SPR-II and SPR-III) are fast-burst core reactors capable of pulse and limited steady-state operation. SPR-II and SPR-III are used primarily for high-dose-rate testing of electronic devices.

ANNULAR CORE RESEARCH REACTOR (ACRR) – DEFENSE PROGRAMS (DP) CONFIGURATION

Function and Description:

The mission of the ACRR, operating in the DP configuration, is to provide neutron and sustained gamma pulsed environments to perform experiments, including those for DP system's components electronics testing. Part of a larger complex located in Technical Area-V, the ACRR is located in Building 6588 and is primarily a low-power research reactor facility. The facility is comprised of the reactor room, low bay, control room, building utilities, several small laboratories, and support staff offices.

The ownership of the ACRR was transferred to the U.S. Department of Energy, Office of Nuclear Energy, for application to radioisotope production. As a result, there are two options for providing an ACRR neutron effects test capability for DP if that should be required in the future: the current molybdnenum-99 ACRR could be reconfigured to allow pulse testing for a "window" of time in the molybdnenum-99 operation; or the DP configuration could be reconstituted using the existing fuel in a new tank in another location in TA-V (a detailed description is being developed).

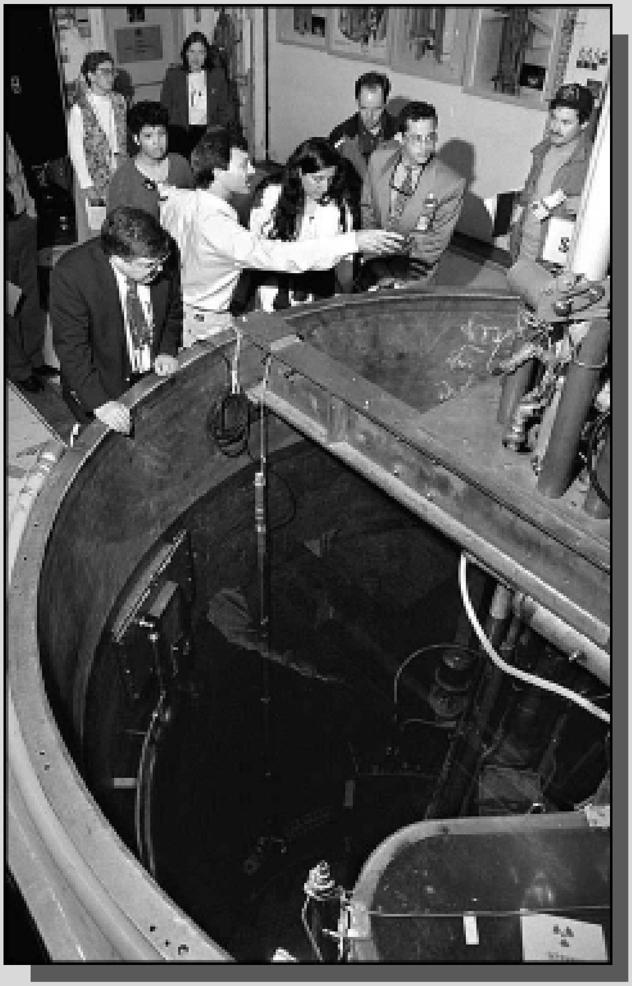
Specific Processes, Activities, and Capabilities:

The ACRR in the DP configuration is a water-moderated and -reflected, low-power research reactor that uses enriched uranium oxide-beryllium oxide cylindrical fuel elements arranged in a close-packed hexagonal lattice around a central experiment cavity. The reactor has several features for conducting experiments, including a dry cavity in the central core region and a radiography tube, and is capable of producing a high yield of high-energy neutrons in the central dry cavity over a very short period of time. The reactor is operated by means of the reactor instrumentation and control system in either the short-duration, steady-state power mode at 2 megawatts or less, or the fast-pulse mode. Specific research activities involve neutron effects on fissile components, radiation effects on various types of electronics, radiography, and testing of materials and systems.

The DOE has identified a recent short-term need to conduct a single test series related to certification of some weapons components (Weigand 1999a). This test would be conducted in the existing ACRR facility, which would have to be temporarily reconfigured to restore DP testing capability (for 12 to 18 months following the Record of Decision) (Weigand 1999b). During this time, medical isotopes preparation and validation testing would be integrated with the weapons certification testing schedule. The reconfiguration to ACRR-DP would be done so that conversion back to ACRR-medical isotope production would be more efficient.

The reconfiguration activities to restore the ACRR to the DP test configuration would mainly consist of replacing the central cavity, enabling the pulse mode of operation, reconfiguring the core fuel, reinstalling the appropriate fuel-ringed external cavity (if required), and executing the necessary battery of tests, documentation, and reviews to certify that the reconfigured reactor is operational. Tests conducted for DP could include weapons systems and components or other DP hardware. After irradiation, test packages could be stored in the ACRR storage holes or similar storage and handling space in the Sandia Pulsed Reactor facility while awaiting shipment, disposal, or examination. Following the test, these changes would be reversed to restore the reactor for isotopes production. Each reconfiguration (isotopes production-to-DP or DP-to-isotopes production) would likely take several months to complete. If a DP test is needed after a new isotopes production core (fuel elements with no pulse test capability) has been installed, the total reconfiguration time would be increased to allow for a complete core refueling to switch back to the uranium oxide-beryllium oxide fuel.

The ACRR facility contains a small chemical inventory and a radioactive nuclear material inventory. Chemical emissions, including alcohols, ketones, and other solvents, are possible and are associated with various aspects of surface preparation, cleaning, and material processing including quality control. Radioactive air emissions are produced at this facility when the energy released during a test interacts with air and produces argon-41. The nuclear material inventory includes enriched uranium fuel, plutonium-239, and cobalt-60.



Source: SNL/NM 1998a

FD–21. Annular Core Research Reactor (ACRR)–Defense Programs (DP) Configuration

The ACRR is a pool-type research reactor capable of steady-state, pulse, and tailored-transient operation.

ANNULAR CORE RESEARCH REACTOR (ACRR) – MEDICAL ISOTOPES PRODUCTION CONFIGURATION

Function and Description:

The mission of the ACRR, operating in the medical and research isotopes production configuration, is the production of medical and research isotopes, primarily molybdenum-99, whose daughter, technetium-99m, is used in nuclear medicine applications. The potential exists for expanding the range of isotopes produced to cover the broad field of medical isotopes and various research isotopes. Located in Building 6588 in Technical Area-V, the ACRR is part of a larger complex that includes two other major structures, Buildings 6580 and 6581. Building 6588 comprises the reactor room, low bay, control room, building utilities, several small laboratories, and support staff offices. Operating in the medical isotopes production configuration, the facility is primarily a low-power medical isotopes production reactor facility.

Specific Processes, Activities, and Capabilities:

In the medical isotopes production configuration, the ACRR would operate for 52 weeks to irradiate targets to produce approximately 30 percent of the U.S. demand (on average) for molybdenum-99 and other isotopes such as iodine-131, xenon-133, and iodine-125. The estimates for the years 2003 and 2008 assume that the Sandia National Laboratories/New Mexico medical isotopes production program operates primarily as a backup to Nordion, Inc., the current supplier for the U.S. market, producing a nominal 30 percent of U.S. demand level. This would require the irradiation of about 375 highly enriched uranium targets per year.

The isotopes production needs may require varying scenarios that would range from periods of shutdown to periods of operation at 100 percent of the U.S. demand level (approximately 25 targets per week). However, it is anticipated that the annual total would not exceed approximately 1,300 targets irradiated in a particular year (100 percent production level). The irradiation schedule could require reactor operations that vary from as little as a single worker shift (typically an 8-hour shift) for only a few days per week to 24-hour-per-day, 7-day-per-week operation. The U.S. Department of Energy has evaluated this program in an environmental impact statement (DOE/EIS-0249F) and has issued a record of decision that addresses operations and production levels to meet the entire U.S. demand continuously at this facility.

The long-term, steady-state operation of the reactor for isotopes production allows the associated use of the reactor for neutron irradiation, radiography experiments, and other activities that are suitable for concurrent use of the ACRR while it is in operation for the production of isotopes.

The ACRR in the medical isotopes production configuration contains a small chemical inventory and a radioactive nuclear material inventory. Chemical emissions, including alcohols, ketones, and other solvents, are possible and are associated with various aspects of surface preparation, cleaning, and material processing including quality control. Radioactive air emissions are produced at this facility when the energy released during operation interacts with air and produces argon-41. The nuclear material inventory includes enriched uranium fuel and cobalt-60.

Source: SNL/NM 1998a

**FD–22. Annular Core Research Reactor (ACRR)–
Medical Isotopes Production Configuration**

Production Site–Jeff Wemple of Isotopes Project and Compliance Initiatives Dept. 9361 peers toward the center of the ACRR where targets are placed for irradiation.

HOT CELL FACILITY (HCF)

Function and Description:

The mission of the HCF, located in Technical Area-V, is to operate primarily as a medical isotopes production facility that supports the U.S. Department of Energy's (DOE) Isotopes Production and Distribution Program (IPDP). Among other activities, the IPDP has responsibility for ensuring that the U.S. health care community has access to a reliable supply of molybdenum-99. The IPDP activities at Sandia National Laboratories/New Mexico (SNL/NM) would provide the only domestic capability to produce a continuous supply of molybdenum-99 and related medical isotopes and is currently under modification for enhanced production capability. Targets produced at Los Alamos National Laboratory are irradiated in the Annular Core Research Reactor (ACRR) and then transferred to the HCF for processing. Besides molybdenum-99, other isotopes produced in the process include iodine-131, xenon-133, and iodine-125.

Specific Processes, Activities, and Capabilities:

A few days after its production, molybdenum-99 decays to form metastable technetium-99m, the most widely used medical radioisotope in the U.S. The primary operations and capabilities of the HCF are geared to support efficient isotopes production. Experiments and chemical and material science analysis activities with radioactive and other hazardous materials can be accommodated, but would impact isotopes production. If isotopes production is low during a period, it may be possible to accommodate some limited experiments in support of other programs.

Isotopes production operations and associated capabilities of the HCF include receipt, extraction, and separation processing of molybdenum-99 from the irradiated targets. In addition, isotopes product packaging and quality sample extraction is also performed. Quality control analysis samples are produced in the ventilation hoods, using small quantities of prepared chemicals. Isotopes product final packaging is performed in the product packaging and shipping area. Finally, radioactive waste neutralization and solidification is done at the HCF prior to offsite disposal.

The HCF would process approximately 30 percent of the U.S. demand for molybdenum-99 and other isotopes, such as iodine-131, xenon-133, and iodine-125. This would require the processing of about 375 irradiated highly-enriched uranium targets per year. The production needs may require varying scenarios that would range from periods of shutdown to periods of operation at 100 percent of the U.S. demand level (approximately 25 targets per week). However, it is anticipated that the annual total would not exceed approximately 1,300 targets processed in a particular year. The HCF associated facilities would be in use continuously for activities that fall within their operating parameters.

The predominant HCF radiological air emissions result from the chemical separation of molybdenum-99 from irradiated fission targets including isotopes of iodine, krypton, and xenon. A variety of chemicals (corrosives, solvents, organics, and inorganics) in gaseous (including hydrogen), liquid, and solid forms, in relatively small quantities, are used in many of these specific processes. Chemical emissions, including corrosives, alcohols, ketones, and other solvents, are associated with various aspects of surface preparation, cleaning, material processing, manufacturing, testing, and quality control.

Source: SNL/NM 1998a

FD–23. Hot Cell Facility (HCF)

The HCF at SNL/NM is a highly shielded area for the remote handling, processing, storage, and analysis of radioactive materials.

CONTAINMENT TECHNOLOGY TEST FACILITY - WEST

Function and Description:

The Containment Technology Test Facility - West conducts containment model testing for the U.S. Nuclear Regulatory Commission and the Nuclear Power Engineering Test Center, Tokyo, Japan. The facility is located in the Coyote Test Field and includes two scale-model containment buildings. One model is a 1:4 to 1:6 scale representation of a two-buttress, prestressed concrete containment structure with a flat concrete base, cylindrical sides, and hemispheric dome. The other model is a 1:8 to 1:10 scale steel containment structure that will be fabricated in Japan and shipped to Sandia National Laboratories/New Mexico for testing. All support facilities will be temporary and portable.

Both the prestressed concrete containment structure and the steel containment structure will be tested to failure by pneumatic over-pressurization with nitrogen gas. Following the test program, the sites will be restored (SNL/NM 1997b).

Specific Processes, Activities, and Capabilities:

The Containment Technology Test Facility-West operations are allocated, but not limited, to the following:

- Nuclear Regulatory Commission activities involve testing the reactor containment building.
- Other projects not associated with the U.S. Department of Energy include work for the Nuclear Power Engineering Corporation, Tokyo, Japan, and consist of activities needed to support reactor containment research and development.

Both the prestressed concrete containment structure and steel containment were constructed to be tested to failure by pneumatic overpressurization with nitrogen gas. Operations include planning, analysis, instrumentation, pressure testing, and data acquisition.

A variety of chemicals (adhesives, corrosives, solvents, organics, and inorganics) in gaseous, liquid, and solid forms in relatively small quantities will be used in material handling and maintenance. Small quantities of air emissions result during operations. Radioactive air emissions are not produced at this facility. Noise generation during construction should be moderate, and the sound pressure wave from catastrophic failure testing of the models will dissipate to below 145 dB at the boundary of the exclusion zones.

Source: SNL/NM 1998a

FD–26. Containment Technology Test Facility - West

EXPLOSIVES APPLICATIONS LABORATORY (EAL)

Function and Description:

The mission of the EAL, located in Building 9930 in the Coyote Test Field, is to support the design, assembly, and testing of explosive experiments. The facility is essentially a laboratory used to design, assemble, and test explosives. The EAL is a low-hazard, nonnuclear facility.

Specific Processes, Activities, and Capabilities:

The EAL is used to test the performance of explosive or energetic materials together with materials and components as part of various systems or subsystems. Other activities include fabrication and assembly of explosion test packages and operation of a small machine shop.

Operations at the EAL support the following programs and initiatives:

- U.S. Department of Energy (DOE) Direct Stockpile Activities in support of research, development, application, and surveillance of energetic materials and components.
- Experimental activities support the development and testing of a full range of explosive devices, components, subsystems, and complete systems. The site is also used for activities that support Nuclear Safety testing requirements, Nuclear Emergency Search Team activities and other similar programs
- Work for other agencies not associated with the DOE in the development and testing of explosive devices, components, subsystems, and complete systems in support of nuclear safety testing requirements.

A variety of chemicals (corrosives, solvents, organics, and inorganics) in gaseous (acetylene for welding), liquid, and solid forms, in relatively small quantities, are used for surface preparation, cleaning, material processing, fabrication of test parts, pre-explosive testing, and quality control. Associated emissions include corrosives, alcohols, ketones, and other solvents. Additional emissions are associated with the conduct of outdoor explosive tests. Nondestructive tests, using X-rays and lasers, are conducted within the facility.

Source: SNL/NM 1998a

FD–26. Explosives Applications Laboratory

The EAL is used to design, assemble, and test explosives.

AERIAL CABLE FACILITY

Function and Description:

The primary mission of the Aerial Cable Facility, located in the Coyote Test Field, is to help ensure that the nation's nuclear weapons systems meet the highest standards of safety and reliability. The Aerial Cable Facility is a restricted-access field test facility consisting of several cables spanning Sol Se Mete canyon. The Aerial Cable Facility comprises a control building, explosives assembly building, instrument bunker, and several explosive storage facilities (magazines and igloos). The complex conducts precision testing of full-scale, air-deliverable weapon systems using realistic target engagement scenarios for verification of design integrity and performance. Activities at the facility include explosives storage and assembly, rocket motor staging and assembly, and test data collection.

Specific Processes, Activities, and Capabilities:

Testing activities at the Aerial Cable Facility include gravitational accelerated (drop) tests and rocket sled pull-down tests. The rocket pull-down technique uses towing cables to accelerate rocket sleds carrying the test items. The test items are released from the overhead cable as the rockets are ignited and directed toward a target. Multiple types of targets can be simulated for worst-case scenarios involving weapons systems, defensive systems, shipping containers, and transportation systems.

Operations at the Aerial Cable Facility support the following programs and initiatives:

- U.S. Department of Energy (DOE) programs in support of Direct Stockpile Activities involving environmental, safety, and survivability testing for nuclear weapons applications.

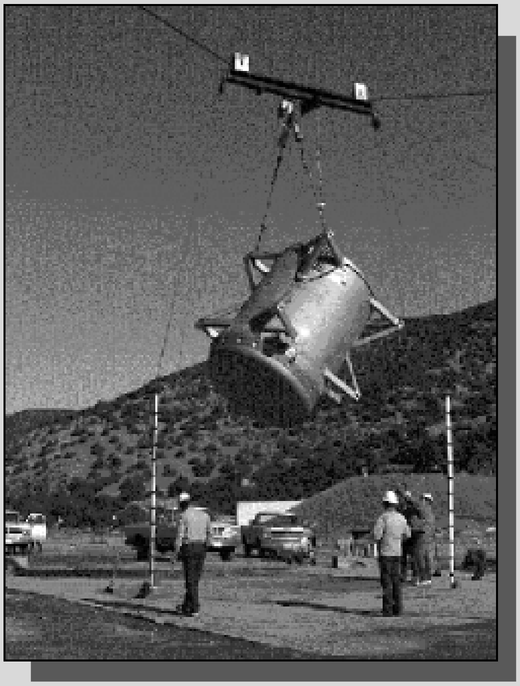
- Joint-funded Research and Development Special Projects between the DOE and the U.S. Department of Defense to exploit and transfer the technology base resident at the DOE national laboratories for the development of advanced, cost-effective, nonnuclear munitions.

- Performance Assessment, Science, and Technology support to the DOE to provide full-scale, highly instrumented impact environments, aircraft crash environments, captive flight, and missile intercept simulation, as well as providing elevated hoisting capability for advanced sensor development and parachute testing.

- Support to Major Program Initiatives such as sustaining Critical Progress in Model Validation designed to provide controlled environments for high-velocity experiments in code validation, such as penetrator performance in frozen soil.

- Work for other entities that are not associated with the DOE, including aerial targets tests and drop/pull-down tests.

Operations require the use of a variety of chemicals (corrosives, solvents, organics, and inorganics) in gaseous, liquid, and solid forms, in relatively small quantities. No radioactive emissions are produced at this facility. Compressed gases used in the assembly areas include acetylene and oxygen (for welding), argon, and helium. There are some chemical emissions, including alcohols, ketones, and other solvents. Small amounts of airborne emissions, including carbon monoxide and lead, are released during explosives tests. Operations associated with preparation of test payloads, fixtures, and rocket sleds involve machining that generates residues, bonding of parts with epoxies, cleaning of parts, and wiping of excess materials.



Source: SNL/NM 1998a

FD–27. Aerial Cable Facility

The Aerial Cable Facility is used for drop tests and rocket sled pull-down tests.

LURANCE CANYON BURN SITE

Function and Description:

The mission of the Lurance Canyon Burn Site, located in the Coyote Test Field, is to help ensure that the nation's nuclear weapons systems meet the highest standards of safety and reliability. The facility is specifically designed for the validation of analytical modeling and the functional certification of weapons systems. The Lurance Canyon Burn Site is also used to test and evaluate the design integrity and performance of weapon components and shipping containers in the event of their accidental exposure to various fires. In addition, the Lurance Canyon Burn Site is used extensively for transportation package certification and to verify designs in transportation technology.

Specific Processes:

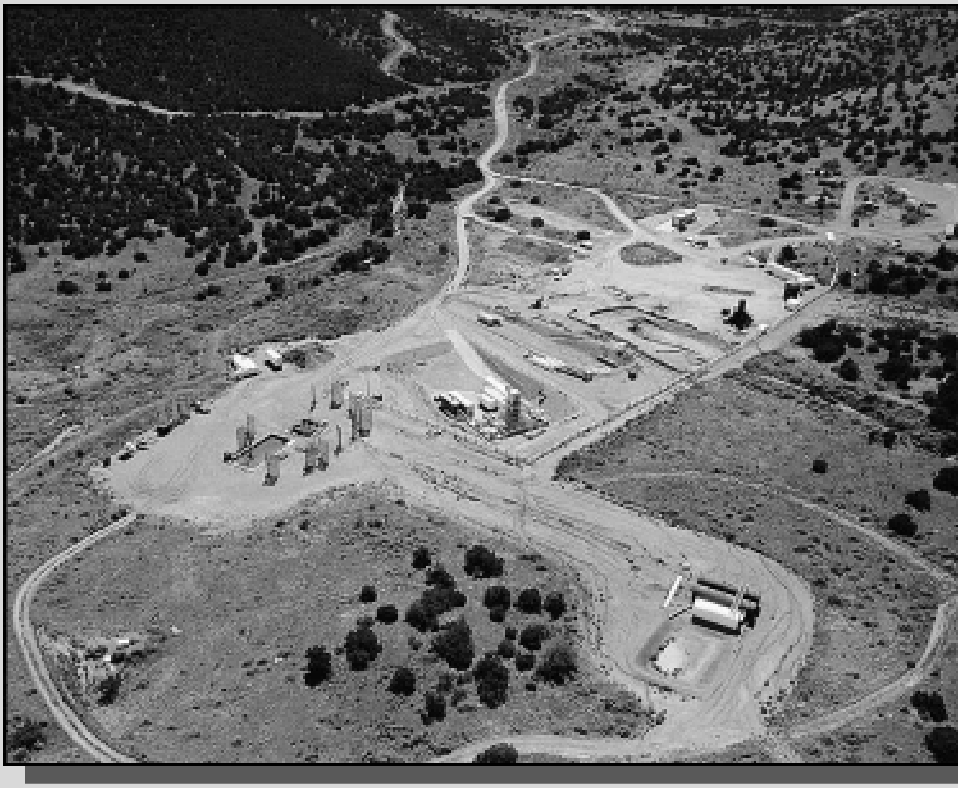
Aviation fuel fire tests are conducted at a combination of outdoor and indoor test facilities. There are four outdoor test areas with water pools to simulate the burning of fuels spilled on open water surfaces. Various test objects may be placed on pool surfaces during test events. Duration of test fires vary from 60 to 150 minutes. The principal emission products from aviation fuel fires are carbon dioxide, carbon soot, and very small amounts of carbon monoxide.

There are three indoor test facilities used for conducting tests similar to those performed outdoors (that is, on the surface of water), but under more controlled conditions (that is, no wind), per test specifications and to provide emission controls when required. Operations at the Lurance Canyon Burn Site support the following programs and initiatives:

- U.S. Department of Energy (DOE) Direct Stockpile Activities in support of Environmental, Safety, and Survivability testing for nuclear weapon applications.
- DOE Performance Assessment Science and Technology Programs to simulate fuel fire environments for testing and certification of weapon systems and components.
- DOE Programs in support of Environmental Technology Management.
- Support to Major Program Initiatives such as sustaining Critical Progress in Model Validation to verify models for fire characterization such as air and fuel mixing, vortices, soot production and destruction, soil and fuel interactions, and enclosure fires driving a hot-gas layer as a function of ventilation; and model validation of component and system response, such as fire-induced response of polyurethane foam, devolitization processes, and burn front movement.
- Work for other entities not associated with the DOE for research and development activities in the national interest. Major Program Initiatives such as Energy Programs including support to Transportation Package Certification Programs to verify designs in Transportation Technology.

There is also an outdoor test facility that uses wood fires or crib fires for certifying U.S. Department of Transportation explosive component shipping containers.

To support test preparations, the Lurance Canyon Burn Site contains a small chemical inventory but no radioactive material. Chemical emissions, including alcohols, ketones, and other solvents, are associated with various aspects of surface preparation, cleaning, and material processing including quality control of test packages. The Lurance Canyon Burn Site has been classified a low-hazard, nonnuclear facility.



Source: SNL/NM 1998a

FD–28. Lurance Canyon Burn Site

The Lurance Canyon Burn Site is used to test shipping containers and weapons components.

THUNDER RANGE COMPLEX

Function and Description:

Historically, the mission of the Thunder Range Complex, located southeast of Technical Area-III, has been environmental, safety, and survivability testing of nuclear weapon components. Current activities at the site are primarily associated with the disassembly, inspection, and documentation of special items, such as nonnuclear munitions. The complex includes other capabilities, such as outdoor explosives or shock-tube testing, although none is scheduled or planned in the foreseeable future.

Specific Processes, Activities, and Capabilities:

The specific processes at the Thunder Range Complex are focused on the evaluation of test materials. Evaluation activities involve physical examination, cleaning, mechanical disassembly, physical measurement, sampling, and photography of test materials.

The Thunder Range Complex also has a combination of essential characteristics not available at any other single Sandia National Laboratories/New Mexico location. These include

- conductive floors and grounding provisions for handling explosives;
- explosive storage bunkers;
- alarms and security provisions for “vault classification,” allowing for classified work;
- established explosive quantity distance boundaries; and
- a 4,000-lb explosive materials handling rating.

Thunder Range projections are provided for two primary activities: equipment disassembly and evaluation and ground truthing tests.

Examination of objects in support of Equipment Disassembly and Evaluation activities is done on an as-needed basis. The site may be used continuously for 30- to 60-days once a year for this activity, or used only 1 to 2 days per month throughout the year. Operations and activities occurring at the Thunder Range Complex support the following programs and initiatives:

- Direct Stockpile Activities conduct survivability testing of nuclear weapon systems and components.
- Arms Control and nonproliferation activities include conventional weapon disassembly and inspection work.
- Special Projects include projects not associated with the U.S. Department of Energy (DOE) involving disassembly, inspection, and evaluation.
- Work for other agencies not associated with the DOE for the disassembly, inspection, and documentation of special items, including special nonnuclear munitions, and joint work with the U.S. Air Force Research Laboratory (formerly called Phillips Laboratory or Air Force Weapons Laboratory). Use of Thunder Range for the placement of targets for testing airborne sensors may also be performed in support of various U.S. Department of Defense (DoD) agencies.

- DOE Programs in Arms Control and Nonproliferation for disassembly and inspection.
- DOE and DoD support to Nonproliferation Verification Research and Development, including aerial observation activities.

The Thunder Range Complex maintains a small inventory of chemicals, but no radioactive material inventory. Various aspects of the preparation and evaluation of test materials can result in emissions from a variety of solvents, including alcohols and ketones. Although sealed sources are not part of any permanent inventory at the Thunder Range Complex, they may also be present at the complex as part of a test sponsor's radiation monitoring device. Radioactive air emissions are not produced at this facility.

Source: SNL/NM 1998a

FD–29. Thunder Range Complex

The Thunder Range Complex is used for testing explosives.

Steam Plant

STEAM PLANT

Function and Description:

The mission of the steam plant is to provide uninterrupted steam supply through a steam distribution system to all of Sandia National Laboratories/New Mexico Technical Area (TA)-I and Kirtland East. The steam is used for heating domestic hot water and for building heat and freeze protection. The steam is also essential to various other programmatic missions, such as those conducted at the Standards Laboratory and the Microelectronics Development Laboratory.

Specific Processes, Activities, and Capabilities:

The steam plant consists of five operational boilers with supporting systems that supply steam to TA-I buildings, U.S. Department of Energy buildings, and U.S. Air Force buildings from Eubank to Pennsylvania Boulevards and from O Street to the Wyoming Boulevard base gate. For the majority of buildings in TA-I, steam is the only heating medium used; therefore, during winter months, the plant is a critical operation because it could have a direct impact on the mission of the laboratories.

The five boilers in the plant are all dual-fired (dual-fuel capability) and collectively have the capacity to provide 370,000 lb per hour of steam to the distribution system. This capacity is much greater than the current or anticipated supply requirements. The boilers are primarily fired on natural gas and use #2 diesel fuel as an emergency backup during natural gas pressure interruptions.

The steam plant contains a chemical inventory and no radioactive material inventory. Chemicals include phosphate, sulfite, amine, and salt to maintain water and steam quality. Chemical emissions include alcohols, ketones, and other solvents. Emissions from other cleaning agents are possible and are associated with various aspects of boiler preparation, cleaning, and steam production quality control. Criteria pollutants are produced from the burning of an estimated 779 million standard cubic feet of natural gas to supply 544 million pounds of steam annually. Radioactive air emissions are not produced at this facility. For backup fuel, 1.5 million gallons of diesel fuel are stored in reserve.

Source: SNL/NM 1998a

FD–30. Steam Plant

The steam plant provides steam to TA-I and Kirtland East.

HAZARDOUS WASTE MANAGEMENT FACILITY (HWMF)

Function and Description:

The HWMF, located in Technical Area–II, performs safe handling, packaging, short-term storing, and shipping (for recycling, treatment, or disposal) of all nonradioactive *Resource Conservation and Recovery Act* (RCRA)-regulated and other hazardous and toxic waste categories (except explosives). The HWMF is a low-hazard facility that consists of two permanent buildings: the Waste Packaging Building (Building 959) and the Waste Storage Building (Building 958). Both buildings are located within an 8-ft-high single fence enclosure. Additionally, the following structures are located at the facility within the fenced area:

- six supply sheds,
- two self-contained prefabricated storage structures,
- a waste oil storage area,
- a catchment pond, and
- three office trailers.

Specific Processes, Activities, and Capabilities:

Hazardous, nonradioactive chemical waste (excluding explosive waste), which is generated by Sandia National Laboratories (SNL) operations described in the RCRA Part B Permit, is collected and transported to the HWMF for packaging and short-term (less than 1 year) storage prior to offsite transportation for recycling, treatment, or disposal at a licensed facility. The waste is managed in accordance with the RCRA Part B Permit. The HWMF also manages small amounts of waste from other SNL or U.S. Department of Energy (DOE) operations, such as SNL's Advanced Materials Laboratory on the University of New Mexico campus in Albuquerque or the DOE's Albuquerque Operations Office.

In the normal conduct of business, contract personnel use a variety of power equipment such as hydraulic drum handlers and empty drum compactors, forklifts, lift trucks, flatbed trucks, and hauling trucks. Personnel routinely handle containers of various nonradioactive hazardous waste, including oxidizers, flammable waste, and irritants. Personnel typically handle waste on a day-to-day basis.

No radioactive materials and no explosive materials are managed at the HWMF. Chemical emissions are small and related to the waste handled in the HWMF.

Source: SNL/NM 1998a

FD–31. Hazardous Waste Management Facility (HWMF)

The HWMF is used for handling, packaging, short-term storing, and shipping of nonradioactive RCRA waste and other hazardous and toxic waste.

RADIOACTIVE AND MIXED WASTE MANAGEMENT FACILITY (RMWMF)

Function and Description:

The RMWMF at Sandia National Laboratories (SNL)/New Mexico serves as a centralized facility for receipt, characterization, compaction, treatment, repackaging, certification, and storage of low-level waste (LLW), transuranic (TRU) waste (including mixed TRU), and low-level mixed (LLMW) waste. The RMWMF is used for extended storage until disposal (or treatment) sites are identified that could accept these materials. The RMWMF is located in the southeastern portion of Technical Area-III and includes Buildings 6920, 6921, and 6925, and the land, structures, and systems on the paved area within the compound fence. Building 6920 is known as the Waste Management Facility; Building 6921 is the Waste Assay Facility; and Building 6925 is the Waste Storage Facility. Other structures include prefabricated, skid-mounted storage buildings (used for storage of reactive waste, flammable waste, and compressed gas cylinders); a paved outdoor LLW and LLMW storage area; an unpaved (gravel) outdoor storage area for LLW; a lined retention pond designed to hold site surface water runoff, the sprinkler discharge from a design fire, and fire-hose streams; and office trailers.

Building 6920 is designed to manage classified and unclassified waste and includes waste storage and staging areas, drum compactor rooms, and areas for *Resource Conservation and Recovery Act* (RCRA)-regulated hazardous waste treatment. Buildings 6921 and 6925 are used for limited RCRA-regulated hazardous waste storage and treatment activities. Building 6921 provides waste characterization capabilities. The maximum storage capacity at the RMWMF is approximately 285,000 ft^3.

Specific Processes, Activities, and Capabilities:

Activities at the RMWMF include unpacking, sorting, repackaging, sampling, storing, staging, treating (dewatering, separating, neutralizing, solidifying, stabilizing, amalgamating, cutting, decontaminating, and compacting), and preparing waste for offsite shipment to a permitted disposal site. Most of this waste is generated by SNL. Small amounts may be generated by other SNL or U.S. Department of Energy (DOE) activities such as DOE funded research at the lovelace Respiratory Research Institute at Kirtland Air Force Base.

Most LLMW stored in Buildings 6920 and 6921 exhibits the characteristic of toxicity (for example, from heavy metals), or contains RCRA F-listed constituents (such as paper products contaminated with trace quantities of solvents). Negligible quantities of corrosive, ignitable, or reactive waste are stored in Buildings 6920 and 6921. Reactive, ignitable, and flammable waste and combustible liquid waste are stored in skid-mounted storage sheds that are located at a safe distance from the buildings. Liquid waste is stored with secondary containment.

Hazard control at the RMWMF is maintained by using the following engineered features, as needed: waste containers, secondary containment, glove boxes, fume hood, air supply and exhaust systems, high-efficiency particulate air filters, air monitoring systems, radiation area monitor system, breathing air supply, fire detection and notification system, fire suppression system, and backup electrical power generator.

Operations that generate radioactive air emissions include preparation of tritium waste for shipment in Building 6920. Radioactive air emissions are monitored through the use of stack monitors. All detectable releases are from tritium, based on sampling the stack effluent. Small sealed radioactive sources are stored at the RMWMF. Some sealed radioactive sources are used for calibrating equipment, such as emission stack monitors. Chemical emissions are small and related to the waste handled in the RMWMF.

Source: SNL/NM 1998a

FD–32. Radioactive And Mixed Waste Management Facility (RMWMF)

The RMWMF is used for characterization, repackaging, and certification of radioactive waste.

Thermal Treatment Facility

THERMAL TREATMENT FACILITY (TTF)

Function and Description:

The TTF, located in the northeast corner of Technical Area-III, is used to thermally treat (burn) small quantities of waste explosive substances, waste liquids (for example, water and solvents) contaminated with explosive substances, and waste items (for example, rags, wipes, and swabs) contaminated with explosive substances. No radioactive waste is treated at the Thermal Treatment Facility.

The TTF consists of a square burn pan of 3/8-inch steel, 29.25 inches on each side and 5-5/8 inches deep. A remotely operated metal lid can be raised to open or lowered to cover the burn pan. A grated metal cage, which is open to the air and is approximately 4 ft on each side and 8 ft tall, encloses the burn pan. The burn cage sits in the center of a steel-lined concrete pad approximately 13 ft on each side with a 4-inch-high curb at the perimeter. The concrete pad is surrounded on the west, south, and east sides by an 8-ft-tall earthen berm. An 8-ft-high chain link security fence surrounds the entire TTF. Three gates, located on the north side of the fence, provide access to the facility. A door on the north side of the burn cage provides access to the burn pan.

Specific Processes, Activities, and Capabilities:

The TTF conducts thermal treatment of CHNO (comprised entirely of elemental carbon, hydrogen, nitrogen, and oxygen) explosives; waste propellants and pyrotechnics; waste items that are contaminated with CHNO high explosives, waste propellants, and pyrotechnics; and liquids that are contaminated with CHNO high explosives, waste propellants, and pyrotechnics.

Emissions include carbon monoxide, nitrogen compounds, sulfur compounds, and other compounds associated with the specific type of explosive material treated.

Source: SNL/NM 1998a

FD–33. Thermal Treatment Facility (TTF)